

Records of Pauropoda (Pauropodidae; Brachypauropodidae; Eury-pauropodidae) from Singapore, Indonesia and Malaysia with the description of 18 new species (Pauropoda and Symphyla of the Geneva Museum XV)

Ulf SCHELLER

Häggeboholm, Häggesled, S-53194 Järpås, Sweden.

Records of Pauropoda (Pauropodidae; Brachypauropodidae; Eury-pauropodidae) from Singapore, Indonesia and Malaysia with the description of 18 new species (Pauropoda and Symphyla of the Geneva Museum XV). - A collection of 104 Pauropoda (Myriapoda) from Southeast Asia was studied. Twenty-seven species were identified, 18 of them are new to science and are described here. These are: *Allopauropus serapiensis* sp. n., *A. cibodasensis* sp. n., *A. javanus* sp. n., *A. bidentulus* sp. n., *A. arcuatus* sp. n., *A. acuticaudis* sp. n., *A. prolongatus* sp. n., *A. divaricatus* sp. n., *A. bakoensis* sp. n., *A. crassus* sp. n., *A. curtus* sp. n., *A. quadrispinus* sp. n., *A. trapezoides* sp. n., *Scleropauropus singapuranus* sp. n., *Samarangopus trilix* sp. n., *S. tuberosus* sp. n., *S. interstinguus* sp. n., *S. sarawakensis* sp. n. Most species in this collection have not been found elsewhere, indicating a high degree of endemism. The wide range element is poor in species.

Keywords: Myriapoda - taxonomy - soil fauna - Southeast Asia - biogeography.

INTRODUCTION

In November and December 1987 an entomological expedition from the Natural History Museum, Geneva, visited Singapore, Indonesia (Java, Bali) and Malaysia (Sarawak). The members, Drs Bernd Hauser, Charles Lienhard and Pierre Strinati, collected 104 specimens of Pauropoda from litter and subsoil, mainly by means of automatic extraction and to a less degree manually. Twenty-seven species are present belonging to six genera in three families: Pauropodidae (*Allopauropus*, *Rabaudauropus* and *Scleropauropus*), Brachypauropodidae (*Brachypauropoides*) and Eury-pauropodidae (*Samarangopus* and *Sphaeropauropus*). This material made it possible to report Pauropoda for the first time from Singapore, Bali and Sarawak. Two species are now known from Singapore (*Scleropauropus singapuranus* sp. n. and *Samarangopus tuberosus* sp. n.), one species from Bali (*Allopauropus quadrispinus* sp. n.) and 18 species from Sarawak, 13 of them new to science (*Allopauropus serapiensis* sp. n., *A. bidentulus* sp. n., *A. arcuatus* sp. n., *A. acuticaudis* sp. n., *A. prolongatus* sp. n., *A. divaricatus* sp. n., *A. bakoensis* sp. n., *A. curtus* sp. n., *A. crassatus* sp. n., *A. trapezoides* sp. n., *Samarangopus trilix* sp. n., *S. interstinguus* sp. n., *S. sarawakensis* sp. n.) and five species previously known from other countries (*Allopauropus man-*

jakotompensis Remy, *A. proximus* Remy, *Rabaudauropus dispar* Scheller, *Brachypauropoides penanorum* Scheller, *Samarangopus longipenes* Scheller). Six additional species can be listed for the Javanese fauna (*Allopauropus mortensenii* (Hansen), *A. pulcher* (Remy), *A. pumilio* Remy, *A. javanus* sp. n., *A. cibodasensis* sp. n. and *Sphaeropauropus arcuatus* Scheller).

MATERIAL AND METHODS

Abbreviations: ad., subad. ... and juv. ... = an adult, a subadult or a juvenile specimen with the number of pairs of legs indicated. Descriptive terms are listed in Scheller, 1988.

Measurements: body length of holotype and range of body lengths of adult paratypes are given in mm in brackets. Other indications of absolute lengths are given in μm . When relative lengths are used the reference value is stated in the text.

Collecting has been made either by hand or by soil samples, the latter extracted in Berlese funnels at places indicated.

The material, preserved in alcohol, is deposited in the pauropod collection of the Department of Arthropods and Entomology I, Natural History Museum of Geneva, Switzerland.

In the section Systematics the collectors are given by surnames only.

PREVIOUS KNOWLEDGE

The Pauropoda fauna of the south-eastern Oriental region is poorly known by a few records only: Hansen (1902), a small collection of nine species from the island of Koh Chang in the Gulf of Siam; Silvestri (1930), two species from Java; Remy (1933), one species from central Vietnam; Attems (1938) and Scheller (2004), one and eight species respectively from Vietnam; Remy (1957d), six species from the Philippines, the Palau Islands and Guam; Scheller *et al.* (1994) and Scheller (2001), six and 14 species respectively from Sabah on northern Borneo and Scheller (1995), 11 species from north-western Thailand.

The picture of a poorly investigated Pauropoda fauna in this part of the world is strengthened by the almost complete lack of knowledge about the northern part of the Australian region. Only three publications deal with that region: Remy (1957b) and Scheller (1993), one and 22 species, respectively, from New Caledonia, and Scheller (1996) one species from Papua New Guinea.

With few exceptions the collections studied by the above authors are small, but taken together they indicate a most diversified fauna.

SYSTEMATICS

Order TETRAMEROCERATA

PAUROPODIDAE

Pauropodinae

Genus *Allopauropus* Silvestri, 1902

Subgenus *Decapauropus* Remy, 1957 (Remy, 1957a).

1. *Allopaupopus (D.) proximus* Remy

Allopaupopus proximus Remy, 1948a: 572-573, fig. 4.

MATERIAL EXAMINED: Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample from between buttresses of large trees (extraction at Kuching, Sarawak), alt. 50 m, 4 ad. ♀, 8.XII.1987 (loc. Sar-87/60, leg. Hauser); Bako National Park, Jalan Lintang, soil sample (extraction in Geneva) from between buttresses of *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae), alt. 30 m, 2 ad. ♀, 2 juv. ♂, 11.XII.1987 (loc. Sar-87/76, leg. Hauser). - Altogether 10 specimens.

GENERAL DISTRIBUTION: This species is widely and discontinuously distributed in the tropics and subtropics of the Americas, Africa and southern Asia. It is here reported for the first time from Sarawak.

2. *Allopaupopus (D.) mortensenii* (Hansen)

Paupopus mortensenii Hansen, 1902: 382-385, pl. 5, figs 1a-c.

MATERIAL EXAMINED: Indonesia, Java, Bogor, Botanical Garden, soil sample from between buttresses of large trees near "Guest House" (extraction at Bogor), alt. ≈250 m, 2 ad. ♀, 24.XI.1987 (loc. Sar-87/8, leg. Hauser). - Altogether 2 specimens.

GENERAL DISTRIBUTION: This species is here reported for the first time from Java. It was described from the island of Koh Chang in the Gulf of Thailand (Hansen, 1902) and has later been reported also from Egypt (Remy, 1950), Réunion (s. n. *Allopaupopus* cf. *mortensenii*, Remy, 1956e), Mauritius (s. n. *Allopaupopus* cf. *mortensenii*, Remy, 1959), Sri Lanka (Remy, 1962; Scheller, 1970). There is also a doubtful record from Australia.

3. *Allopaupopus (D.) manjakotompensis* Remy & Bello

Allopaupopus manjakotompensis Remy & Bello, 1960: 86-88, fig. 8.

MATERIAL EXAMINED: Malaysia, Sarawak, Bako National Park, Jalan Tg. Sapi, soil sample from between buttresses of large trees (extraction in Geneva), alt. 10 m, 1 juv. ♂, 2 juv. ♀, 11.XII.1987 (loc. Sar-87/80, leg. Hauser). - Altogether 3 specimens.

GENERAL DISTRIBUTION: This species is previously known from two localities on Madagascar only (Remy & Bello, 1960).

4. *Allopaupopus (D.) pulcher* Remy

Allopaupopus pulcher Remy, 1956c: 445-446, figs 1-3.

MATERIAL EXAMINED: Indonesia, Java, Cibodas, Botanical Garden, alt. 1300 m, 1 ad. ♀, 25.XI.1987 (loc. Sar-87/18, leg. Hauser).

GENERAL DISTRIBUTION: This species is here reported for the first time from Java. It was previously known only from the type locality in South Africa and from a few places in the USA: Texas (Remy, 1956d) and Great Smoky Mountains National Park (Scheller & Bernard, 2005).

5. *Allopaupopus (D.) pumilio* Remy

Allopaupopus pumilio Remy, 1956e: 148-149, fig. 7.

MATERIAL EXAMINED: Indonesia, Java, Bogor, Botanical Garden, soil sample from between buttresses of large trees near the two lakes (extraction at Bogor), alt. 260 m, 2 ad. ♀, 24.XI.1987 (loc. Sar-87/11, leg. Hauser). - Altogether 2 specimens.

GENERAL DISTRIBUTION: The species is here reported for the first time from Java. It was known earlier from the type locality on La Réunion only.

6. *Allopauropus (D.) serapiensis* sp. n.

Figs 1-11

TYPE MATERIAL: Holotype: ad. ♀, Malaysia, Sarawak, Gunung Serapi at road Kuching-Matang, soil sample in forest at the road to the television station (extraction at Kuching, Sarawak), alt. 670 m, 9.XII.1987 (loc. Sar-87/64, leg. Hauser). Paratype: same data as for holotype, 1 ad. ♀.

OTHER MATERIAL: Malaysia, Sarawak, Bako National Park, Jalan Lintang, soil sample from between buttresses of *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae) (extraction in Geneva), alt. 30 m, 4 ad. ♀ (2♂, 2♀), 1 subad. ♂ (sex?), 2 juv. ♀, 2 juv. ♂, 11.XII.1987 (loc. Sar-87/76, leg. Hauser). – Altogether 11 specimens.

ETYMOLOGY: A latinized adjective of the name Serapi.

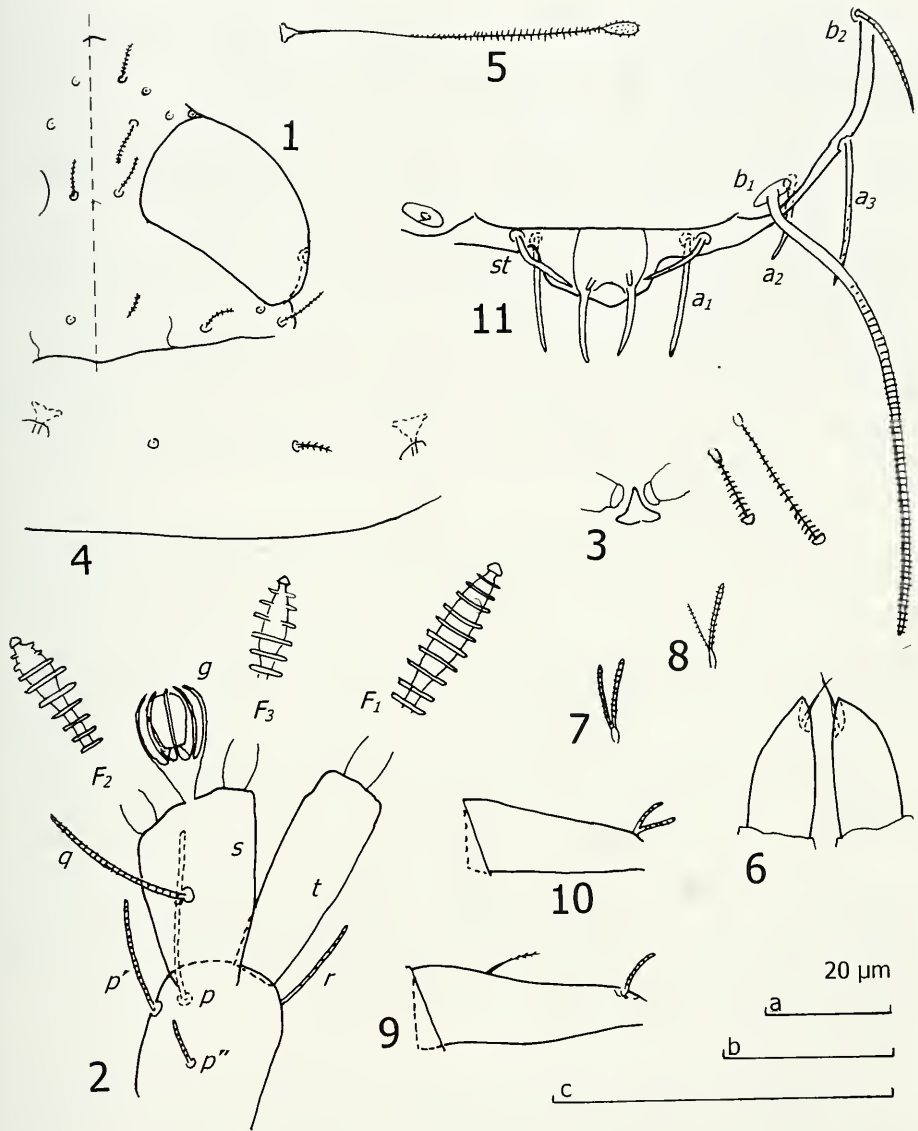
DIAGNOSIS: Several pygidial characters (shape of anal plate, setae of tergum and sternum, shape of posterior margin of tergum) indicate that *A. serapiensis* sp. n. is close to *A. (D.) absimilis* Scheller from southern Vietnam (Scheller, 2004). Good distinctive characters are the shape of the antennal globulus (proportionately long, with ovoid capsule in *A. serapiensis* sp. n.; short, with almost spherical capsule in *A. absimilis*), the proportions of the tergal antennal branch (5.3 times as long as its greatest diameter and 1.8 times as long as sternal branch in *A. serapiensis* sp. n.; 2.2-2.6 and 0.9-1.1 respectively in *A. absimilis*) and the shape of the tarsus of the last pair of legs (2.7-3.2 times as long as its greatest diameter in *A. serapiensis* sp. n., 4.5 in *A. absimilis*).

DESCRIPTION: *Length* = 0.41(-0.43) mm.

Head (Fig. 1): Most tergal setae lost, those present short, very thin, tapering, pointed, striate. Relative lengths of setae (holotype only), 1st row: $a_1 = 10$, $a_2 = ?$; 2nd row: $a_1 = 13$, a_2 and $a_3 = ?$; 3rd row: $a_1 = 10$, $a_2 = ?$; 4th row: $a_1 = a_2 = 10$, $a_3 = ?$, $a_4 = 12$; lateral group: $l_1 = ?$, $l_2 = 8$, $l_3 = 15$. Ratio $a_1/a_1 - a_1$ in 1st and 2nd row 0.6, 3rd row 0.8, 4th row 0.7. Temporal organs large, at least twice longer than their shortest interdistance; small pistil in posterior part. Head cuticle glabrous.

Antennae (Fig. 2): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae cylindrical, densely striate. Relative lengths of setae: $p = 100$, $p' = (57-)$ 60, $p'' = (28-)$ 30(-32), $r = 60(-)$ 76. Tergal seta p about as long as tergal branch t . The latter somewhat fusiform, (2.2-2.6 times as long as its greatest diameter and about as long as sternal branch s , this (1.5-1.7 times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q cylindrical, blunt, densely striate, almost as long as (-1.3 times as long as) length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = (4-)$ 5; $F_2 = (24-)$ 33(-37), $bs_2 = 3(-)$ 4; $F_3 = 70(-)$ 78, $bs_3 = 5(-)$ 6. F_1 4.9(-5.8) times as long as t , F_2 and F_3 (1.6-1.8(-2.0) and (3.5-4.5 times as long as s , respectively. Distal calyces with small caps and distal part of flagella axes fusiformly widened. Globulus g 1.6(-1.8) times as long as wide and its width (0.9-1.1 of greatest diameter of r ; ≈ 8 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 3) simple, somewhat clavate, blunt, annulate. Sublateral seta (1.6-1.9 times as long as submedian seta; sternite process narrow anteriorly and without apical incision; appendages barrel-shaped, caps with distinctly bent surface. Process and appendages glabrous.



FIGS 1-11

Allopauopus (D.) serapiensis sp. n., 1-5, 7-11, holotype, ad. 9(♀); 6, paratype, ad. 9(♂). (1) head, median and right part, tergal view; (2) left antenna, sternal view; (3) collum segment, median and left part, sternal view; (4) tergite VI, posterior part; (5) T_3 ; (6) genital papillae, anterior view; (7) seta on coxa of leg 9; (8) seta on trochanter of leg 9; (9) tarsus of leg 9; (10) tarsus of leg 8; (11) pygidium, tergal view. Scale a: Figs 1, 5; b: Figs 3-4, 6-10; c: Figs 2, 11.

Setae on tergites as submedian setae on head; 4+4 setae on tergite I, 6+6 on II-IV, 6+? on V and 4+2 on VI. Posterior setae on tergite VI (Fig. 4) 0.2(-0.3) of interdistance and about 0.5 of length of pygidial setae a_1 .

Bothriotricha (Fig. 5): Relative lengths: $T_1 = 100$, $T_2 = ?(125)$, $T_3 = (101-)$ 114, $T_4 = (108-)$ 130, $T_5 = (146-)$ 182). All with straight and very thin axis. T_3 thickest and with apical ovoid swelling, 0.1 of length of bothriotrix. Pubescence very short except below end-swelling of T_3 , the latter with very short, simple hairs.

Genital papillae (Fig. 6, paratype): 2.1 times as long as their greatest diameter, proximal half subcylindrical, distal half conical, with outer side strongly curved, glabrous; distal seta short, very thin, 0.4 of length of papilla.

Legs: Setae on coxa (Fig. 7) and trochanter (Fig. 8) of leg 9 short, furcate, branches thin, cylindrical, striate, secondary branch of seta on trochanter very thin. Corresponding setae on more anterior legs (including setae on coxa of leg 2 in male), simple, cylindrical, without rudiments of secondary branch. Tarsus of leg 9 (Fig. 9) tapering, (2.7-) $3.1(-3.2)$ times as long as its greatest diameter. Setae striate-annulate, proximal seta short, thin, tapering, curved, $\frac{1}{4}$ of length of tarsus and very little longer than distal seta; the latter cylindrical, striate, blunt, almost as long as proximal seta. Cuticle of tarsus glabrous. Distal setae on tarsi of legs 1-8 furcate (Fig. 10), branches cylindrical, striate, blunt.

Pygidium (Fig. 11): *Tergum*. Posterior margin between *st* and above anal plate with a low triangular bulge protruding from a trapezoid base. Relative lengths of setae: $a_1 = 10$, $a_2 = (7-)$ 8, $a_3 = (12-)$ 13(-14), $st = 7(-)$ 8). Setae a_1 , a_2 , and a_3 thin, cylindrical, somewhat curved inwards and converging, only a_3 with faint pubescence distally; *st* tapering, pointed, somewhat curved inwards and with a knee in proximal third. Distance $a_1 - a_1$ 1.3(-1.5) times as long as a_1 , distance $a_1 - a_2$ as long as distance $a_1 - a_1$ and somewhat shorter than distance $a_2 - a_3$; distance $st - st$ 2.2(-2.6) times as long as *st* and 1.2(-1.3) times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 straight. Relative lengths of setae ($a_1=10$): $b_1 = 40(-)$ 46, $b_2 = 10(-)$ 11). Setae tapering, striate, b_2 diverging, somewhat curved inwards. b_1 1.4(-1.5) times as long as interdistance; b_2 0.6 of distance $b_1 - b_2$.

Anal plate large, subquadrate, somewhat longer than broad, with convex lateral margins and broadly V-shaped posteromedian indentation. Each posterolateral corner with two appendages: one directed posteriorly, as long as plate, tapering, the other very short and protruding from sternal side. Long appendages somewhat curved inward, short ones straight, diverging. Plate and sternum glabrous.

7. *Allopaupopus (D.) cibodasensis* sp. n.

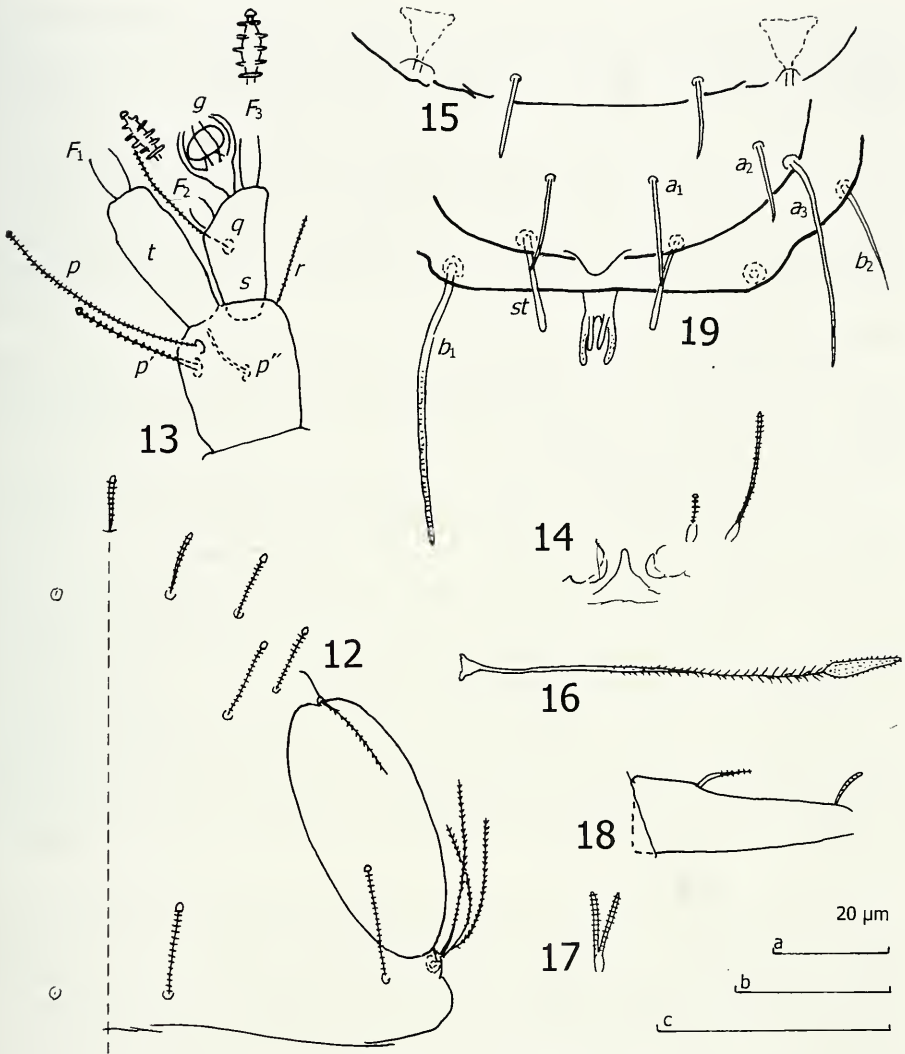
Figs 12-19

TYPE MATERIAL: Holotype: ad. 9(♀), Indonesia, Java, Cibodas, Botanical Garden, alt. \approx 1300 m, 25.XI.1987 (loc. Sar-87/18, leg. Hauser).

ETYMOLOGY: A latinized adjective that refers to the name Cibodas.

DIAGNOSIS: *A. (D.) cibodasensis* sp. n. seems to be a very close relative of *A. (D.) bedosae* Scheller from north-western Thailand (Scheller, 1995). They can be distinguished by the shape of the posterior part of the pygidial sternum (margin straight in *A. cibodasensis* sp. n., with broad indentation in *A. bedosae*) and by the shape of the anal plate (plate short with long appendages in *A. cibodasensis* sp. n., plate longer with short appendages, especially the sternal ones, in *A. bedosae*).

DESCRIPTION: *Length* = 0.51 mm.



FIGS 12-19

Allopaupopus (D.) cibodasensis sp. n., holotype, ad. 9(♀). (12) head, median and right part, tergal view; (13) right antenna, sternal view; (14) collum segment, median and left part, sternal view; (15) tergite VI, posterior part; (16) T_3 ; (17) seta on trochanter of leg 9; (18) tarsus of leg 9; (19) pygidium, tergal view. Scale a: Fig. 16; b: Figs 14, 17-18; c: Figs 12, 13, 15, 19.

Head (Fig. 12): Some tergal setae lost, those present of medium length, somewhat clavate, with distinct endsegment, striate. a_3 in 2nd row tapering, pointed. Relative lengths of setae: 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = 12$, $a_2 = 10$, $a_3 = 15$; 3rd row: a_1 and $a_2 = ?$; 4th row: $a_1 = 13$, $a_2 = ?$, $a_3 = 25$, $a_4 = ?$; lateral group: $l_1 = 27$, $l_2 = 20$, $l_3 = 22$. Ratio $a_1/a_1 - a_1$ in 1st row 0.6, in 2nd row 0.4 and 4th row 0.8. Temporal organs 0.8 of shortest interdistance. Head cuticle glabrous.

Antennae (Fig. 13): Segment 4 with setae p , p' , p'' and r , p''' not ascertained. Setae cylindrical, annulate. Relative lengths of setae: $p = 100$, $p' = 70$, $p'' = 42$, $r = 53$. Tergal seta p 1.2 times as long as tergal branch t . The latter somewhat fusiform, widest near the middle, 2.4 times as long as its greatest diameter and as long as sternal branch s , this 1.7 times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q cylindrical, blunt, striate, 0.9 of length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 6$; $F_2 = 45$, $bs_2 = 3$; $F_3 = 81$, $bs_3 = 7$. F_1 5 times longer than t , F_2 and F_3 2.2 and 4.1 times as long as s , respectively. Distal calyces small, distal part of flagella axes fusiformly widened. Globulus g 1.1 times as long as wide and its width 0.9 of greatest diameter of t ; 9 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 14) simple, somewhat clavate, blunt, annulate. Sublateral seta 3.4 times as long as submedian seta; sternite process small, narrow anteriorly and without apical incision; appendages directed inwards, small, indistinct. Process and appendages glabrous.

Setae on anterior tergites cylindrical, striate, more posteriorly growing glabrous, pointed; 4+4 setae on tergite I, 6+6 on II-V, and 4+2 on VI. Posterior setae on tergite VI (Fig. 15) 0.4 of interdistance and 0.9 of length of pygidial setae a_1 .

Bothriotricha: Relative lengths: $T_1 = 100$, T_2 broken, $T_3 = 95$, $T_4 = 113$, $T_5 = 181$. All with straight, thin axis, T_3 (Fig. 16) thickest, with apical swelling, this almost 0.2 of length of bothriotrix and broadest near base. Pubescence short, longest below endswelling of T_3 , the latter with very short erect hairs.

Legs: Setae on coxa of leg 9 not studied, seta on trochanter of that leg (Fig. 17) furcate, branches subsimilar, cylindrical, striate, blunt. Corresponding setae on more anterior legs simple, striate, blunt. Tarsus of leg 9 (Fig. 18) tapering, 2.7 times as long as its greatest diameter. Setae subequal in length, 0.3 of length of tarsus. Proximal seta tapering, pointed, with short pubescence distally; distal seta cylindrical, blunt, striate. Cuticle of tarsus glabrous.

Pygidium (Fig. 19): *Tergum*. Posterior margin evenly rounded but with small median triangular lobe between a_1 and st . Relative lengths of setae: $a_1 = 10$, $a_2 = 9$, $a_3 = 24$, $st = 14$. Setae a_1 and a_2 straight, somewhat diverging, glabrous, the former cylindrical, the latter tapering, a_3 curved inward, diverging, tapering, st straight, somewhat clavate and converging, glabrous. Distance $a_1 - a_1$ 1.2 times as long as a_1 , distance $a_1 - a_2$ 3.2 times as long as distance $a_2 - a_3$; distance $st - st$ 1.2 times as long as st and 1.4 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin between b_1 straight. Relative lengths of setae ($a_1 = 10$): $b_1 = 33$, $b_2 = 13$. Setae b_1 cylindrical, faintly striate, b_2 somewhat diverging and curved inward, tapering, pointed. b_1 as long as interdistance; b_2 as long as distance $b_1 - b_2$.

Anal plate subquadrate, with concave lateral margins; distal part with 4 posteriorly directed cylindrical blunt appendages, tergal ones thickest, somewhat curved inward, those protruding from sternal side shorter and thinner, somewhat converging; tergal and sternal appendages 1.5 and 1.3 times as long as plate, respectively. Plate and sternum glabrous.

8. *Allopauropus (D.) javanus* sp. n.

Figs 20-28

TYPE MATERIAL: Holotype: ad. ♀, Indonesia: Java, Cibodas, *Lithocarpus-Castanopsis* forest along gorge above the Botanical Garden, under rotten wood, alt. ≈1400 m, 25.XI.1987 (loc. Sar-87/17, leg. Lienhard).

ETYMOLOGY: A latinized adjective of the name Java.

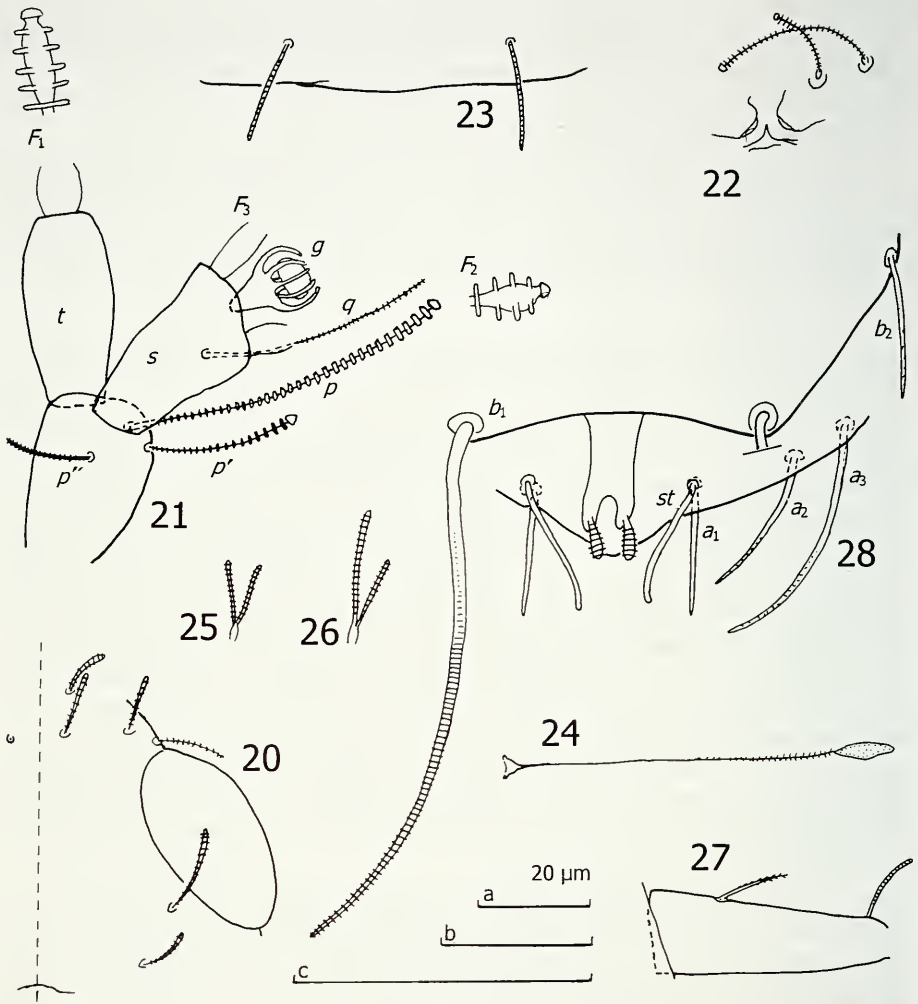
DIAGNOSIS: Among several similar species in the subgenus the new species can be identified by the following combination of characters: flattened base of capsule in antennal globulus, setae of collum segment somewhat claviform and with distinct endsegment, T_3 with distal endswelling with very short pubescence, anal plate with U-shaped posterior incision.

A. javanus sp. n. might be most closely related to two species known from Sri Lanka, *A. (D.) excavatus* Scheller and *A. (D.) baculatus* Scheller (Scheller, 1970), and to the Madagascan *A. (D.) delphini* Remy and *A. (D.) barroisi* Remy (Remy, 1956a). Good distinctive characters are: in relation to *A. excavatus* the proportions of the tergal antennal branch (as long as sternal branch in *A. javanus* sp. n., distinctly longer in *A. excavatus*) and the number of appendages of the anal plate (only two sternal ones in *A. javanus*, two sternal and two tergal ones in *A. excavatus*); in relation to *A. baculatus*, the shape of the pubescence of the bothriotricha (very short in *A. javanus* sp. n., long and with partly branched hairs in *A. baculatus*) and the shape of the T_3 (with distal swelling in *A. javanus* sp. n., no swelling in *A. baculatus*); in relation to *A. delphini*, the shape of the pubescence on the endswelling of the T_3 (endswelling almost glabrous in *A. javanus* sp. n., with long ramose hairs in *A. delphini*) and the shape of the posterior margin of the pygidial tergum (with triangular bulge in *A. javanus* sp. n., no bulge in *A. delphini*); in relation to *A. barroisi*: the shape of the *st* (long, cylindrical in *A. javanus* sp. n., short, clavate in *A. barroisi*). Among these four species the new species may be most close to *A. barroisi* because both have very similar anal plates and the submedian setae a_1 in the 4th row of the tergal setae on the head are lacking in both.

DESCRIPTION. *Length* = 0.46 mm.

Head (Fig. 20): Many tergal setae lost, those present short, somewhat clavate, striate. a_3 in 2nd row cylindrical. Relative lengths of setae (for holotype only), 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = 11$, $a_2 = 10$, $a_3 = 13$; 3rd row: $a_1 = ?$, $a_2 = 14$; 4th row: a_1 not identified, $a_2 = 10$, a_3 and $a_4 = ?$; lateral group, not identified. Ratio $a_1/a_1 - a_1$ not studied. Temporal organs about as long as shortest interdistance. Head cuticle glabrous.

Antennae (Fig. 21): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae p and p' somewhat clavate, annulate, p'' cylindrical, striate. Relative lengths of setae: $p = 100$, $p' = 53$, $p'' = 32$, $r = ?$. Tergal seta p 1.5 times as long as tergal branch t . The latter somewhat fusiform, widest near the middle, 1.6 times as long as its greatest diameter and 1.1 times as long as sternal branch s , this 1.7 times as long as its greatest diameter and with its anterodistal corner moderately truncate. Seta q cylindrical, blunt, densely striate, 1.3 times as long as length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 6$; $F_2 = 45$, $bs_2 = 5$; $F_3 = 90$, $bs_3 = 4$. F_1 4.5 times as long as t , F_2 and F_3 2.2 and 4.3 times as long as s , respectively. Distal calyces small, distal part of flagella axes fusiformly widened. Globulus g 1.2 times as long as wide and its width 0.6 of greatest diameter of t ; ≈9 bracts present. Antennae glabrous.



Figs 20-28

Allopauropus (D.) javanus sp. n., holotype, ad. 9 (♀). (20) head, median and right part, tergal view; (21) right antenna, tergal view; (22) collum segment, median and left part, sternal view; (23) tergite VI, posteromedian part, tergal view; (24) T_3 ; (25) seta on coxa of leg 9; (26) seta on trochanter of leg 9; (27) tarsus of leg 9; (28) pygidium, posteromedian and left part, sternal view. Scale a: Fig. 24; b: Figs 20, 22, 25-27; c: Figs 21, 23, 28.

Trunk: Setae of collum segment (Fig. 22) simple, somewhat clavate, blunt, annulate. Sublateral seta 2.4 times as long as submedian seta; sternite process small, narrow anteriorly and without apical incision; appendages indistinct, caps thin. Process and appendages glabrous.

Setae on tergites cylindrical, blunt, striate; 4+4 setae on tergite I and 4+2 on VI. Posterior setae on tergite VI (Fig. 23) 0.6 of interdistance and 0.8 of length of pygidial setae a_1 .

Bothriotricha: Relative lengths: $T_1 = 100$, $T_2 = 107$, $T_3 = 101$, $T_4 = 123$, $T_5 = 179$. All with straight and very thin axis. T_3 (Fig. 24) thickest, with apical ovoid swelling, this well 0.1 of length of bothriotrix. Pubescence very short except below endswelling of T_3 , the latter almost glabrous.

Legs: Setae on coxa (Fig. 25) and trochanter (Fig. 26) of leg 9 furcate, branches cylindrical, striate, blunt; branches subequal in length on coxal seta, one of the branches distinctly longer than the other on trochanter. Corresponding setae on more anterior legs with somewhat clavate main branch and rudimentary secondary branch. Tarsus of leg 9 (Fig. 27) tapering, 2.8 times as long as its greatest diameter. Setae equal in length, 0.3 of length of tarsus. Proximal seta tapering, pointed, with short pubescent distally; distal seta cylindrical, blunt, very densely striate. Cuticle of tarsus glabrous.

Pygidium (Fig. 28): *Tergum*. Posterior margin between *st* and above anal plate with a triangular lobe. Relative lengths of setae: $a_1 = 10$, $a_2 = st = 11$, $a_3 = 19$. Setae a_1 straight, directed posteriorly, glabrous; a_2 , and a_3 curved inward, converging, the former glabrous, the latter with very faint distal pubescence; *st* somewhat S-shaped, converging, tapering, glabrous. Distance $a_1 - a_1$ 1.2 times as long as a_1 , distance $a_1 - a_2$ 0.6 of distance $a_1 - a_1$ and 1.8 times as long as distance $a_2 - a_3$; distance *st* - *st* 1.2 times as long as *st* and 1.1 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin between b_1 with broad, shallow, bow-shaped indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 41$, $b_2 = 12$. Setae tapering, striate, b_2 somewhat diverging and curved inwards. b_1 1.9 times as long as interdistance; b_2 0.7 of distance $b_1 - b_2$.

Anal plate 2.3 times as long as greatest breadth, lateral margins concave, distal part protruding into two rounded lobes separated by a U-shaped indentation, 0.3 of length of plate. Two clavate striate appendages originating from sternal sides of these lobes and projecting backwards-downwards; these appendages 0.4 of length of plate. Plate and sternum glabrous.

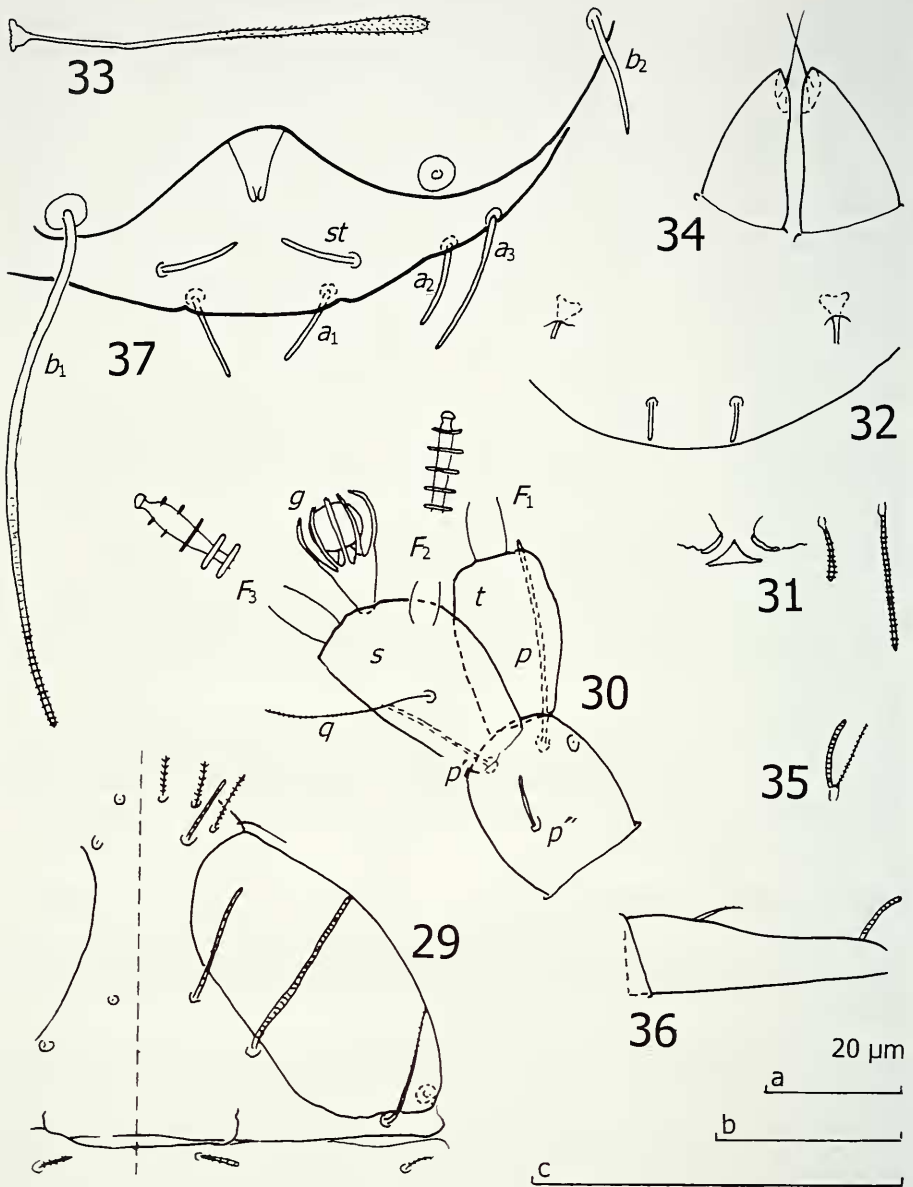
9. *Allopaupopus (D.) bidentulus* sp. n.

Figs 29-37

TYPE MATERIAL: Holotype: ad. 9(♂), Malaysia: Sarawak, Gunung Serapi at road Kuching-Matang, soil sample (extraction at Kuching) from forest at the road to the television station, alt. 670 m, 9.XII.1987 (loc. Sar-87/64, leg. Hauser). Paratypes: same data as for the holotype, 4 ad. 9(2♂, 2♀). - Altogether 5 specimens.

ETYMOLOGY: From the Latin *bi* = two and *dens* = tooth (referring to the distal part of the anal plate).

DIAGNOSIS: *A. (D.) bidentulus* sp. n. is a close relative of *A. (D.) facetus* Remy from Nosy Be, Madagascar (Remy, 1956a). The two species are very alike regarding the general chaetotaxy of the pygidium and the shape of the anal plate. They are well distinguished by the shape of the following characters: antennal globulus *g* (1.5 times as long as its greatest diameter and its length 0.6-0.7 of length of *s* in *A. bidentulus* sp. n., longish, 2.2 times as long as greatest diameter and its length as long as *s* in *A. facetus*); base segments of the antennal flagella (about twice longer than wide in *A. bidentulus* sp. n., 5-6 times longer than wide in *A. facetus* Remy); pygidial setae a_1 (cylindrical and converging in *A. bidentulus* sp. n., somewhat lanceolate and diverging in *A. facetus*).



Figs 29-37

Allopauropus (D.) bidentulus sp. n., holotype, ad. 9(♂). (29) head and anterior part of tergite I, median and right part, tergal view; (30) left antenna, sternal view; (31) collum segment, median and left part, sternal view; (32) tergite VI, posterior part; (33) T_3 ; (34) genital papillae, anterior view; (35) seta on coxa of leg 9; (36) tarsus of leg 9; (37) pygidium, median and left part, tergal view. Scale a: Fig. 33; b: Figs 29, 31-32, 34-36; c: Figs 30, 37.

DESCRIPTION: *Length* = (0.28-)0.35 mm.

Head (Fig. 29): Setae (holotype only) on anterior part of tergal side short, much longer on posterior part. Setae a_1 and a_2 of 4th row not verified. Setae thin, striate. Relative lengths of setae: 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = a_2 = a_3 = 14$; 3rd row: $a_1 = 26$, $a_2 = 36$; 4th row: $a_3 = 28$, $a_4 = ?$; lateral group setae not studied. Ratio $a_1/a_1 - a_1$ in 1st row 1.0, in 2nd row 0.7, in 3rd row 1.6. Temporal organs proportionally large, 3.1 times as long as their shortest interdistance. Small posterior aperture close to posterior margin of temporal organ. Head cuticle glabrous.

Antennae (Fig. 30): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae cylindrical, annulate. Relative lengths of setae (holotype only): $p = 100$, $p' = ?$, $p'' = 27$, $r = 46$. Tergal seta p 1.2 times as long as tergal branch t . The latter somewhat fusiform, widest near the middle, 1.5 times as long as its greatest diameter and 0.8 of length of sternal branch s , this (1.4-)1.6 times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q thin, cylindrical, blunt, faintly striate, about as long as s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 5(-6)$; $F_2 = 33(-38)$, $bs_2 = 3$; $F_3 = 68(-76)$, $bs_3 = (6-)7$. F_1 (5.6-)6.7 times as long as t , F_2 and F_3 1.8(-1.9) and (3.5-)3.6 times as long as s , respectively. Distal calyces small, distal part of flagella axes somewhat widened in F_1 and F_3 , not in F_2 . Globulus g 1.4 times as long as wide and its width 0.8 of greatest diameter of t ; 9 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 31) simple, cylindrical, blunt, striate. Sublateral seta 2.1(-2.2) times as long as submedian seta; sternite process small, narrow anteriorly and without apical incision; appendages small, indistinct. Both process and appendages glabrous.

Setae on anterior tergites cylindrical, striate, more posteriorly growing glabrous. 4+4 setae on tergite I, 4+2 on VI. Posterior setae on tergite VI (Fig. 32) 0.4 of interdistance and 0.8 of length of pygidial setae a_1 .

Bothriotricha: Relative lengths (holotype only): $T_1 = 100$, $T_2 = 88$, $T_3 = 80$, $T_4 = 68$, $T_5 = 121$. All but T_3 with straight, very thin axis, T_3 (Fig. 33), with apical swelling, this 0.2 of length of bothriotrix. Pubescence short, on T_1 , T_2 , T_4 and T_5 extremely short, longest pubescence below endswelling of T_3 , the latter with short almost erect hairs.

Genital papillae (Fig. 34): Short, conical with rounded outer sides, 1.8 times as long as their greatest diameter, glabrous; distal seta very thin, 0.5 of length of papilla.

Legs: Setae on coxa of leg 9 (Fig. 35) short, furcate, striate, branches subsimilar in length, seta on trochanter seems to be simple. Corresponding setae on more anterior legs simple, striate. Tarsus of leg 9 (Fig. 36) tapering, (3.1-)3.2 times as long as its greatest diameter. Proximal seta tapering, pointed, distal one cylindrical, blunt, striate, both 0.2 of length of tarsus. Cuticle of tarsus glabrous.

Pygidium (Fig. 37): *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: $a_1 = 10$, $a_2 = 10(-11)$, $a_3 = (15-)16$, $st = 8$. Setae cylindrical, somewhat curved inward, blunt, glabrous, converging. Distance $a_1 - a_1$ 1.5(-1.6) times as long as a_1 , distance $a_1 - a_2$ about 3 times longer than distance $a_2 - a_3$; distance $st - st$ (2.3-)2.6 times as long as st and (1.1-)1.3 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum: Posterior margin between b_1 with deep, broadly V-shaped indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 56(-58)$, $b_2 = 14(-15)$. Seta b_1 cylindrical,

somewhat tapering, faintly striate distally, b_2 subcylindrical, tapering distally, glabrous, somewhat diverging. b_1 1.4 times as long as interdistance, b_2 0.6 of distance $b_1 - b_2$.

Anal plate broadest at base, longish, triangular, with straight sides and two appendages most distally; appendages very short, blunt, close to each other. Plate and sternum glabrous.

10. *Allopaupopus (D.) arcuatus* sp. n.

Figs 38-45

TYPE MATERIAL: Holotype: ad. 9(♀), Malaysia, Sarawak, Gunung Serapi at road Kuching-Matang, soil sample (extraction at Kuching) from forest at the road to the television station, alt. 670 m, 9.XII.1987 (loc. Sar-87/64, leg. Hauser).

ETYMOLOGY: From the Latin arcus = bow (referring to pygidial setae *st*).

DIAGNOSIS: Many species in the subgenus have similar anal plates but *A. (D.) arcuatus* sp. n. is distinguished by having also clavate bothriotricha T_3 and cylindrical *st* evenly curved inward like an arc of a circle. The setae a_1 of the 4th row of setae on the tergal side of the head have not been verified.

DESCRIPTION: *Length* = 0.32 mm.

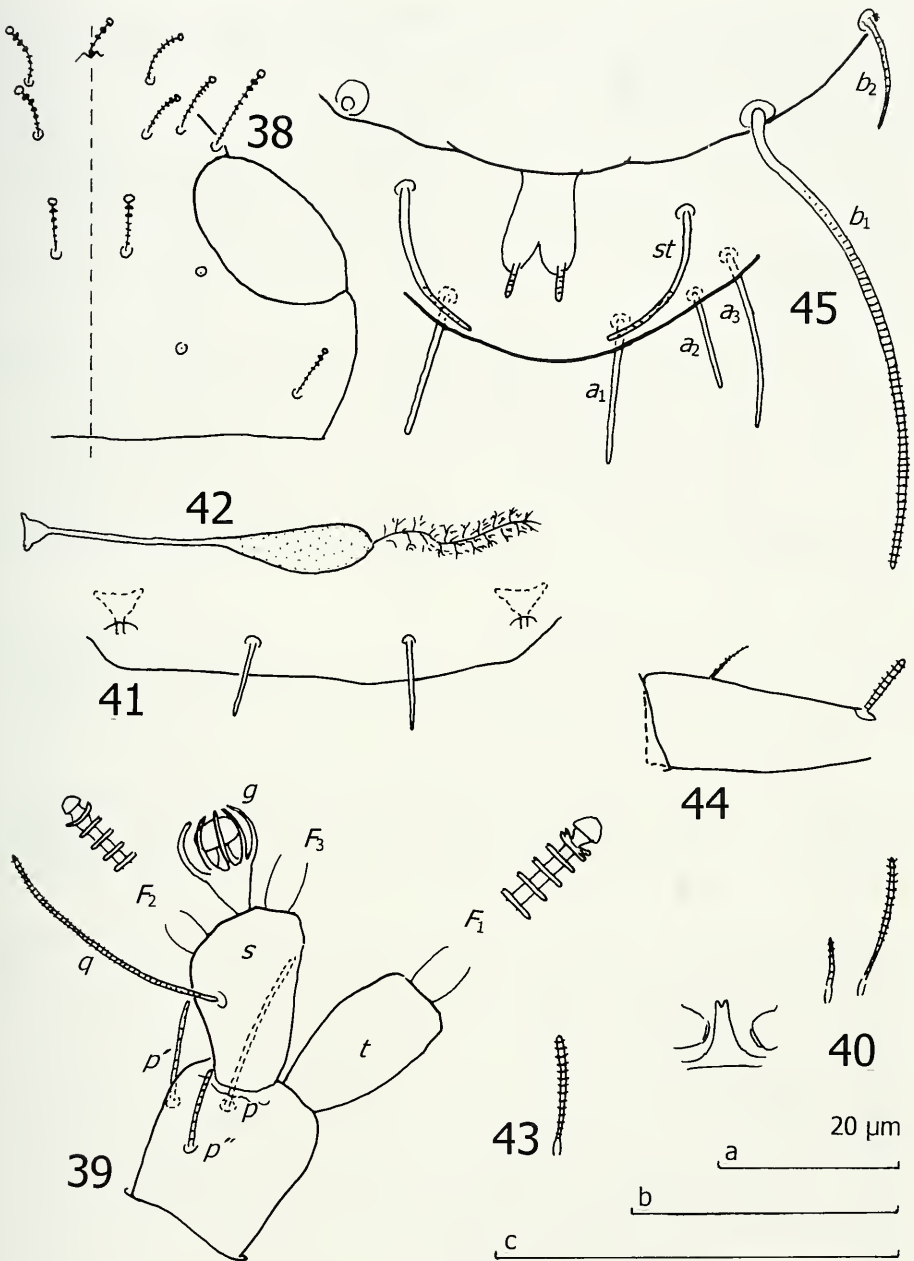
Head (Fig. 38): Tergal setae short, somewhat clavate, annulate, with distinct endsegment. Relative lengths of setae: 1st row: only one pair of setae verified $l = 10$; 2nd row: $a_1 = 9$, $a_2 = 11$, $a_3 = 15$; 3rd row: $a_1 = 9$, $a_2 = ?$; 4th row: a_1 not verified, $a_2 = ?$, $a_3 = 9$, $a_4 = ?$; lateral group of setae not studied. Ratio $a_1/a_1 - a_1$ in 2nd row 0.3, in 3rd row 0.8. Temporal organs proportionally small, as long as shortest interdistance. Head cuticle glabrous.

Antennae (Fig. 39): Segment 4 with at least setae p , p' , and p'' , r and p''' not ascertained. Setae thin, cylindrical, indistinctly striate. Relative lengths of setae: $p = 100$, $p' = 62$, $p'' = 55$. Tergal seta p as long as tergal branch t . The latter somewhat fusiform, widest outside the middle, 1.7 times as long as its greatest diameter and 0.9 of length of sternal branch s , this 1.7 times as long as its greatest diameter and with its anterodistal corner distinctly truncate. Seta q thin, cylindrical, blunt, densely striate, 1.5 times as long as s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 5$; $F_2 = 32$, $bs_2 = 4$; $F_3 = 84$, $bs_3 = 5$. F_1 6.3 times as long as t , F_2 and F_3 1.9 and 4.8 times as long as s , respectively. Distal calyces hemispherical, distal part of flagella axes not widened. Globulus g 1.3 times as long as wide and its width 0.8 of greatest diameter of t ; ≈ 7 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 40) simple, cylindrical, tapering, striate. Sublateral seta 3 times longer than submedian seta; sternite process small, narrow, with small incision anteriorly; appendages small. Process and appendages glabrous.

Setae on anterior tergites cylindrical, striate, more posteriorly growing glabrous. 4+4 setae on tergite I, 4+2 on VI. Posterior setae on tergite VI (Fig. 41) 0.5 of interdistance and 0.8 of length of pygidial setae a_1 .

Bothriotricha: T_1 , T_2 and T_4 lost or broken. Lengths: $T_3 = 49$, $T_5 = 50$ μm . All but T_3 seems to be very thin, T_3 (Fig. 42) with proximal 1/3 of axis cylindrical, middle 1/3 forming a club-shaped swelling, distal 1/3 very thin; proximal part glabrous, middle part maybe with very short pubescence, distal part with long branched hairs arranged in whirls.



Figs 38-45

Allopaupopus (D.) arcuatus sp. n., holotype, ad. 9(♀). (38) head, median and right part, tergal view; (39) left antenna, sternal view; (40) collum segment, median and left part, sternal view; (41) tergite VI, posterior part; (42) T_3 ; (43) seta on coxa of leg 9; (44) tarsus of leg 9; (45) pygidium, median and left part, sternal view. Scale a: Figs 38, 40; b: Figs 41-43; c: Figs 39, 44, 45.

Legs: Setae on coxa (Fig. 43) and trochanter of leg 9 simple, cylindrical, blunt, striate. Corresponding setae on more anterior legs simple, striate, coxal seta somewhat thicker than seta on trochanter. Tarsus of leg 9 (Fig. 44) tapering, 2.4 times as long as its greatest diameter. Proximal seta tapering, pointed, distal one cylindrical, blunt, striate, the former 0.4 and the latter 0.7 of length of tarsus. Cuticle of tarsus glabrous.

Pygidium (Fig. 45): *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: $a_1 = 10$, $a_2 = 7$, $a_3 = st = 13$. Setae cylindrical, blunt, almost glabrous; a_1 and a_2 straight, a_3 and st curved inward, st curved like an arch, a_2 and a_3 diverging, st converging. Distance $a_1 - a_1$ 1.3 times as long as a_1 , distance $a_1 - a_2$ 1.3 times as long as distance $a_2 - a_3$; distance $st - st$ 1.6 times as long as st and distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 with low median bulge. Relative lengths of setae ($a_1 = 10$): $b_1 = 34$, $b_2 = 8$. Setae striate, b_1 subcylindrical, b_2 tapering, somewhat diverging. b_1 1.2 times as long as interdistance, b_2 0.8 of distance $b_1 - b_2$.

Anal plate 1.4 times as long as broad, broadest in distal third, with concave lateral margins; distal part protruding into two rounded somewhat diverging lobes; two cylindrical appendages originating from sternal sides of these lobes and projecting backward; these appendages 0.3 of length of plate, cylindrical, blunt, striate, somewhat diverging. Plate and sternum glabrous.

11. *Allopaupopus (D.) acuticaudis* sp. n.

Figs 46-52

TYPE MATERIAL: Holotype: subad. 8(♀), Malaysia, Sarawak, Bau, in the surroundings of the cave "Gua Puang" near Kampong Pelaman Sekiang, on steep slope of Gunung Jambusan, under bark, alt. 10-30 m, 4.XII.1987 (loc. Sar-87/52, leg. Lienhard).

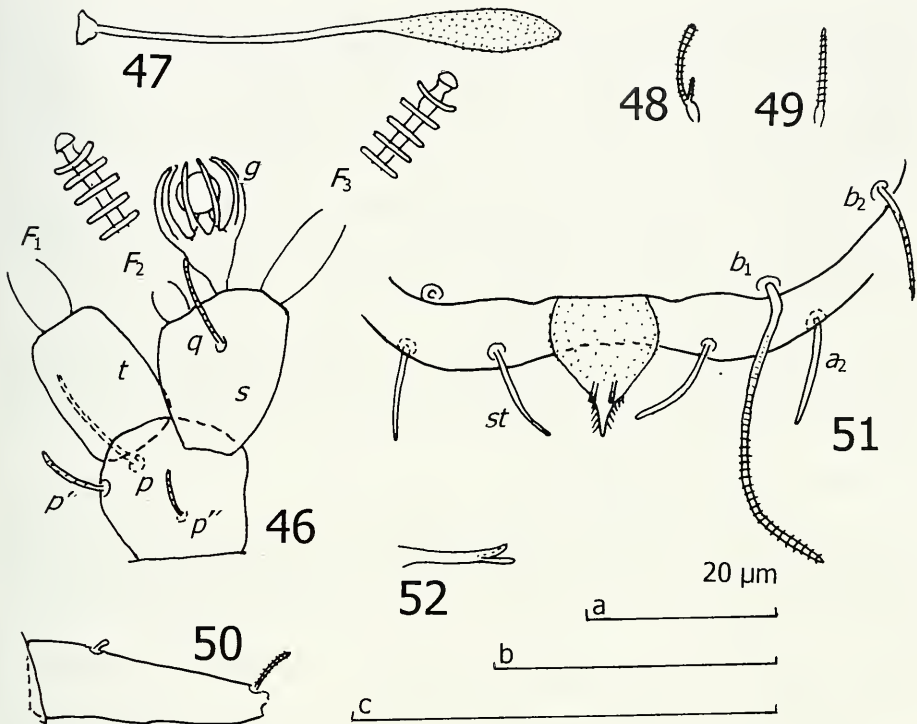
ETYMOLOGY: From the Latin *acutus* = pointed and *cauda* = tail.

DIAGNOSIS: The specimen is not in the best condition (many setae lost) but it is well defined by the peculiar shape of the anal plate in combination with the endswelling of the T_3 and the unusual shape of the proximal seta of the tarsus of the last pair of legs. *A. acuticaudis* sp. n. appears to be most closely related to two Madagascan species, *A. baudoti* Remy and *A. lienharti* Remy (Remy, 1956a). It can be distinguished from *A. lienharti* by the shape of the T_3 (thick, simple, with distal swelling in *A. acuticaudis* sp. n.; thin, branched in *A. lienharti*) and the shape of the distal seta on the tarsi of the last pair of legs (simple in *A. acuticaudis* sp. n.; furcate in *A. lienharti*). Good distinctive characters in relation to *A. baudoti* are the size ratio q/s (0.6 in *A. acuticaudis* sp. n.; 1.7 in *A. baudoti*), the shape of the T_3 (thick, simple, with distal swelling in *A. acuticaudis* sp. n.; thin, tapering in *A. baudoti*) and the shape of the proximal seta on the tarsi of the last pair of legs (very short, blunt, less than 0.1 of length of tarsus and about 0.3 of length of distal seta in *A. acuticaudis* sp. n.; 1/4 of length of tarsus and longer than distal seta in *A. baudoti*). The new species is also related to *A. (D.) digitiger* Remy (Remy, 1956a), but to a less degree.

DESCRIPTION: *Length* = 0.42 mm.

Head: Not available for study.

Antennae (Fig. 46): Segment 4 with at least setae p , p' , and p'' , r and p''' not ascertained. Setae thin, cylindrical, indistinctly striate. Relative lengths of setae: $p = 10$, $p' = 6$, $p'' = 4$. Tergal seta p 0.9 of length of tergal branch t . The latter cylindrical,



FIGS 46-52

Allopauropus (D.) acuticaudis sp. n., holotype, subad. 8 (♀). (46) left antenna, sternal view; (47) T_3 ; (48) seta on coxa of leg 8; (49) seta on trochanter of leg 8; (50) tarsus of leg 8; (51) pygidium, median and left part, sternal view; (52) anal plate, lateral view. Scale a: Figs 48-49; b: Figs 47, 50-52; c: Fig. 46.

1.5 times as long as its greatest diameter and 0.9 of length of sternal branch s , this 1.3 times as long as its greatest diameter and with anterodistal corner distinctly truncate. Seta q proportionately short, thin, cylindrical, blunt, densely striate, 0.6 of length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 9$; $F_2 = 36$, $bs_2 = 5$; $F_3 = 83$, $bs_3 = 13$. F_1 5.3 times as long as t , F_2 and F_3 1.7 and 3.9 times as long as s , respectively. Distal calyces small, hemispherical, distal part of flagella axes not widened. Globulus g 1.4 times as long as wide and its width 0.9 of greatest diameter of t ; ≈ 9 bracts present. Antennae glabrous.

Trunk: Collum segment and setae on tergites not available for study.

Bothriotracha: Only T_3 (Fig. 47) studied, the others broken. Length of $T_3 = 35 \mu\text{m}$, axis thick, with distal swelling, pubescence very short.

Legs: Setae on coxa of leg 8 (Fig. 48) short, furcate, striate, main branch somewhat clavate, striate, secondary branch much thinner and 0.3 of length of main branch; seta on trochanter (Fig. 49) simple, cylindrical, blunt, striate. All corresponding setae on more anterior legs simple, striate. Tarsus of leg 8 (Fig. 50) tapering, 3.3 times as long as its greatest diameter. Proximal seta very short, cylindrical, blunt, glabrous,

distal one cylindrical, blunt, striate; proximal seta less than 0.1 of length of tarsus and 0.3 of length of distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 51): *Tergum*. Posterior margin with broad and shallow indentation between *st*. Lengths of setae: $a_1 = ?$, $a_2 = 7$, $a_3 = ?$, $st = 8 \mu\text{m}$. a_2 and *st* subcylindrical, blunt, glabrous, somewhat curved inward, converging. Distance $st - st$ 2.1 times as long as *st*. *Tergum* glabrous.

Sternum. Posterior margin between b_1 almost straight, with one small bulge only at each side of anal plate. Lengths of setae: $b_1 = 23$, $b_2 = 8 \mu\text{m}$. Seta b_1 cylindrical, striate, b_2 tapering, faintly striate distally, somewhat curved inward. b_1 as long as interdistance, b_2 0.8 of distance $b_1 - b_2$.

Anal plate (Figs 51-52) broadest in proximal half, subcircular, with triangular posterior prolongation; this with one marginal row of hairs on each side and with two short appendages protruding backward from sternal side; appendages subparallel, cylindrical, blunt, glabrous. Plate with faint pubescence, sternum glabrous.

12. *Allopauropus (D.) prolongatus* sp. n.

Figs 53-57

TYPE MATERIAL: Holotype: ad. 9(♀), Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m, 8.XII.1987 (loc. Sar-87/60, leg. Hauser). Paratype: 1 ad. 9(♀), same data as holotype. - Altogether 2 specimens.

ETYMOLOGY: From the Latin pro- = in relation to, and longus = long (referring to the lengthened posterior part of pygidial tergum).

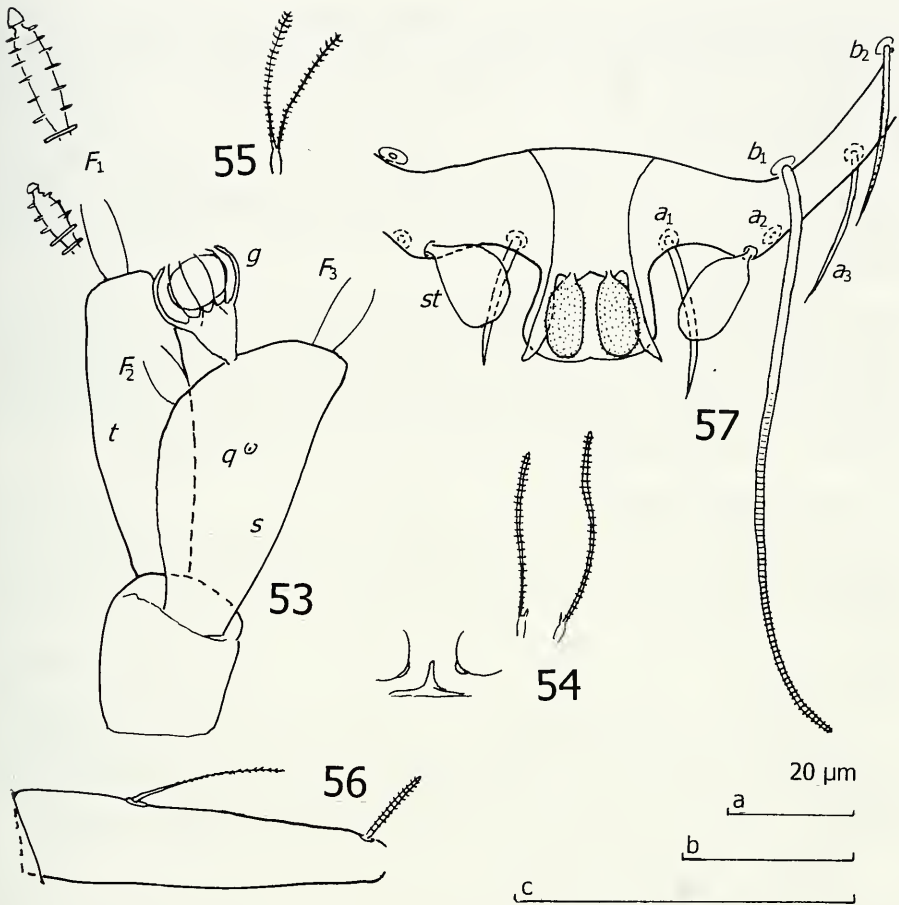
DIAGNOSIS: The type specimens are not in the best condition (many setae lost) but they are well defined by the shape of the anal plate (with balloon-like submedian appendages), the posterior part of the pygidial tergum (with a large posterior lobe) and the *st* (balloon-like). The general morphology of the anal plate is alike that in *A. (D.) ludovicæ* Remy from Corsica (Remy, 1945) but otherwise they are not close to each other. At present the relationships of this species can not be established.

DESCRIPTION: *Length* = 0.75 mm.

Head: Head not available for study.

Antennae (Fig. 53): All setae lost. Tergal antennal branch elongate, somewhat fusiform, distal end obliquely truncate, 3.0 times longer than wide and as long as sternal branch *s*, this 2.2 times as long as its greatest diameter and with its anterodistal corner roundly truncate. Relative lengths of flagella (basal segments included) and basal segments (for holotype only): $F_1 = 100$, $bs_1 = 8$; $F_2 = 53$, $bs_2 = 6$; $F_3 = ?$, $bs_3 = 8$. F_1 3.1 times as long as *t*, F_2 1.7 times as long as *s*. Distal calyces of F_1 conical, those of F_2 small, hemispherical; distal part of flagella axes fusiformly widened. Globulus *g* 1.2 times as long as wide and its width 0.9 of greatest diameter of *t*; 13 bracts present. *Antennae* glabrous.

Trunk: Setae of collum segment (Fig. 54) furcate; main branch subcylindrical, blunt, striate, secondary branch rudimentary, pointed. Setae long, sublateral one 1.3 times as long as submedian seta; sternite process small, narrow anteriorly and without apical incision; appendages subglobular, caps very small. Process and appendages glabrous. Setae on tergites I-VI not studied.



Figs 53-57

Allopauropus (D.) prolongatus sp. n., holotype, ad. 9(♀). (53) left antenna, sternal view; (54) collum segment, median and left part, sternal view; (55) seta on trochanter of leg 9; (56) tarsus of leg 9; (57) pygidium, median and left part, tergal view. Scale a: Figs 55-56; b: Fig. 54; c: Figs 53, 57.

Bothriotricha: Not available for study.

Legs: Setae on coxa and trochanter (Fig. 55) of leg 9 furcate, branches subequal in length, cylindrical, somewhat widened distally, striate, blunt. Corresponding setae on more anterior legs furcate, with rudimentary secondary branch. Tarsus of leg 9 (Fig. 56) tapering, 4.1 times as long as its greatest diameter. Proximal seta thin, tapering, pointed, with very short pubescent most distally, seta 0.4 of length of tarsus and 2.1 times as long as distal seta; the latter cylindrical, blunt, striate. Cuticle of tarsus glabrous.

Pygidium (Fig. 57): *Tergum*. Posterior margin between widely separated *st* with large broadly linguiform lobe above anal plate; between lobe and *st* a distinct but shallow indentation. Relative lengths of setae: $a_1 = a_3 = 10$, $a_2 = ?$, $st \approx 7$. Setae a_1 and

a_3 tapering, pointed, curved inward, glabrous, the former diverging, the latter converging, *st* balloon-shaped, converging, glabrous, at most twice longer than wide. Distance $a_1 - a_1$ 0.9 of length of a_1 , distance $a_1 - a_2$ 0.8 of distance $a_1 - a_1$ and 0.9 of distance $a_2 - a_3$; distance $st - st$ 2.8 times as long as *st* and 2.1 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin with shallow indentation between b_1 . Relative lengths of setae ($a_1 = 10$): $b_1 = 35$, $b_2 = 12$. Setae tapering, striate distally, b_2 pointed, somewhat curved inward. b_1 1.5 times as long as interdistance; b_2 1.1 times as long as distance $b_1 - b_2$. Tergum glabrous.

Anal plate somewhat longer than broad, broadest at base, lateral margins concave, distal margin with shallow median indentation and 4 large appendages: two posterolateral, 0.8 of length of plate, somewhat diverging, pointed, outer margin almost straight, inner margin convex; and two submedian appendages, 0.7 of length of plate, protruding backward from posterior margin of sternal side of plate, these appendages very alike *st* but with very short pubescence. Plate and sternum glabrous.

13. *Allopauropus (D.) divaricatus* sp. n.

Figs 58-66

TYPE MATERIAL: Holotype: ad. 9(♀), Malaysia, Sarawak, Bako National Park, Jalan Lintang, soil sample (extraction in Geneva) from between buttresses of *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae), alt. 30 m, 11.XII.1987 (loc. Sar-87/76, leg. Hauser).

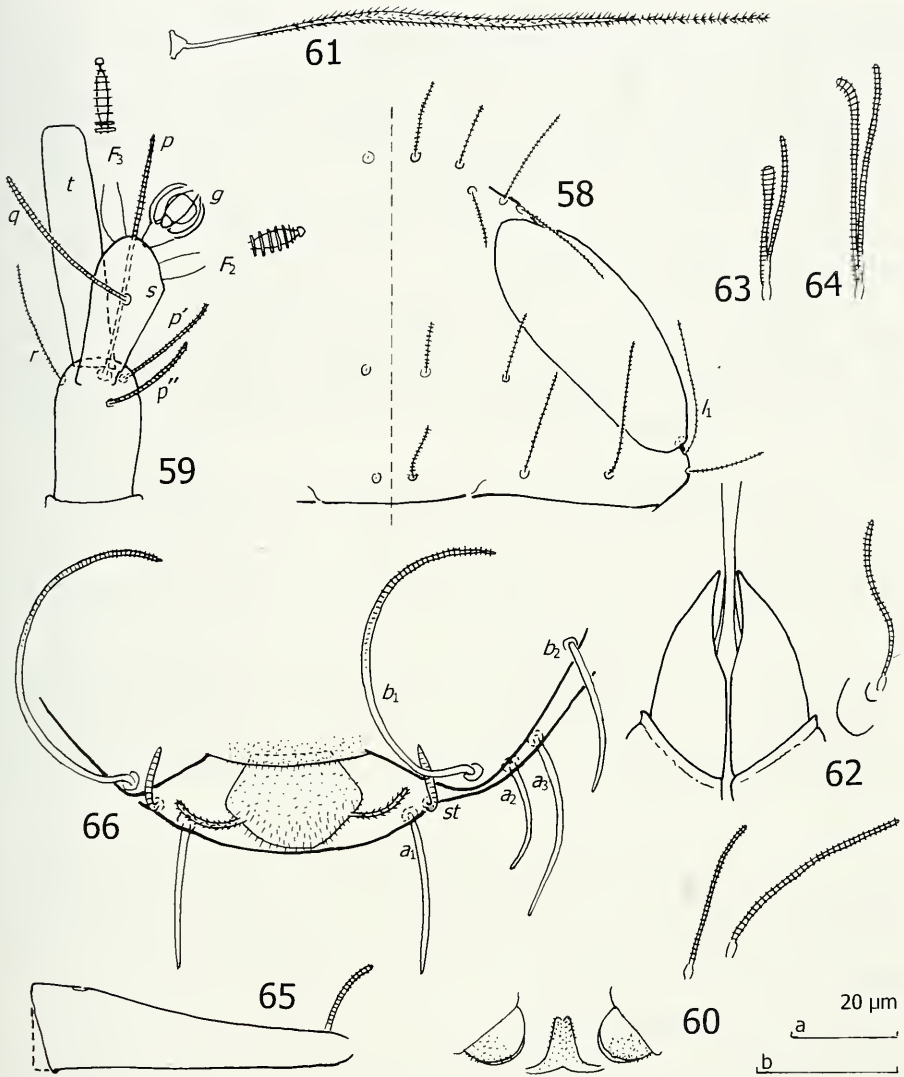
ETYMOLOGY: From the Latin *divarico* = stretch out (referring to the appendages of the anal plate).

DIAGNOSIS: *A. (D.) divaricatus* sp. n. is well delimited by several characters of the pygidium (see below: setae b_1 and *st*, anal plate), and also by the shape of the genital papillae and of the tarsus of the last pair of legs. These partly rare or unique characters, make it impossible to trace the relationships of this species at present.

DESCRIPTION: *Length* = 0.66 mm.

Head (Fig. 58): Setae on tergal side thin striate, of medium length, shortest on posteromedian part. Relative lengths of setae: 1st row: $a_1 = 10$, $a_2 = 8$; 2nd row: $a_1 = 7$, $a_2 = 13$, $a_3 = 11$; 3rd row: $a_1 = 6$, $a_2 = 8$; 4th row: $a_1 = 6$, $a_2 = 13$, $a_3 = 17$, $a_4 = 9$; lateral group setae: $l_1 = 17$, $l_2 = 13$, $l_3 = 11$. Ratio $a_1/a_1 - a_1$ in 1st row 1.8, in 2nd row 0.4, in 3rd row 0.8 and in 4th row 1.4. Temporal organs 1.8 times as long as their shortest interdistance. Small posterior aperture close to posterior margin of temporal organ. Head cuticle glabrous.

Antennae (Fig. 59): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae subcylindrical, blunt, striate. Relative lengths of setae: $p = 100$, $p' = 46$, $p'' = 43$, $r = 49$. Tergal seta p 1.1 times as long as tergal branch t . The latter slender, cylindrical, 4.7 times as long as its greatest diameter and 1.5 times as long as sternal branch s , this 2.2 times as long as greatest diameter and with anterodistal corner distinctly truncate. Seta q as seta p , 1.2 times as long as s . Lengths of flagella (basal segments included) and basal segments: F_1 and bs_1 lost; $F_2 = 52$, $bs_2 = 6$; $F_3 = 120$, $bs_3 = 8 \mu\text{m}$. F_2 and F_3 2.4 and 5.6 times as long as s , respectively. Distal calyces small, distal part of flagella axes fusiformly widened on F_2 , cylindrically widened on F_3 . Globulus g 1.4 times as long as wide, its width 1.1 times as wide as greatest diameter of t ; ≈ 9 bracts present. Antennae glabrous.



FIGS 58-66

Allopaupopus (D.) divaricatus sp. n., holotype, ad. 9(δ). (58) head, median and right part, tergal view; (59) right antenna, sternal view; (60) collum segment, median and left part, sternal view; (61) T_3 ; (62) genital papillae and seta on coxa of leg 2, anterior view; (63) seta on coxa of leg 9; (64) seta on trochanter of leg 9; (65) tarsus of leg 9; (66) pygidium, median and left part, sternal view. Scale a: Figs 58, 61, 65; b: Figs 59-60, 62-64, 66.

Trunk: Setae of collum segment (Fig. 60) long, simple, blunt, striate. Sublateral seta 1.4 times as long as submedian seta; sternite process with anterior incision; appendages subglobular, caps very thin. Process and posterior halves of appendages with short pubescence.

Setae on anterior tergites similar to submedian setae on tergal side of head. 4+4 setae on tergite I, 6+6 on II-V, VI not available for study.

Bothriotricha: Relative lengths: $T_1 = 100$, $T_2 = 120$, $T_3 = 115$, $T_4 = 123$, $T_5 = 170$. All with straight simple axes, all but T_3 very thin with, extremely short pubescence most distally. T_3 (Fig. 61) with axis thickest in proximal 2/3, then growing very thin, pubescence strong, hairs simple, oblique.

Genital papillae (Fig. 62): 2.7 times as long as greatest diameter, conical, base obliquely truncate, distal part thin, strongly tapering, glabrous, distal seta proportionately long, 0.8 of length of papilla.

Legs: Setae on coxa (Fig. 63) and trochanter (Fig. 64) of leg 9 long, furcate, striate, main branch somewhat clavate, secondary branch cylindrical, branches sub-similar in length. Corresponding setae on more anterior legs simple, striate. Tarsus of leg 9 (Fig. 65) strongly tapering, 3.5 times as long as its greatest diameter. Proximal seta lost, distal one cylindrical, blunt, striate, 0.3 of length of tarsus. Cuticle of tarsus glabrous.

Pygidium (Fig. 66): *Tergum*. Posterior margin rounded, with broad rounded bulge between *st*. Relative lengths of setae: $a_1 = 100$, $a_2 = 68$, $a_3 = 118$, $st \approx 50$. These setae tapering, a_1 , a_2 and a_3 curved inward, a_1 and a_2 glabrous, a_3 with very short pubescence distally, *st* curved downward, striate. Distance $a_1 - a_1$ 1.4 times as long as a_1 , distance $a_1 - a_2$ 3 times longer than distance $a_2 - a_3$; distance $st - st$ 1.2 times as long as *st* and 1.2 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin between b_1 with broad median indentation. Relative lengths of setae ($a_1 = 100$): $b_1 = 240$, $b_2 = 98$. Seta b_1 curved downward-forward, somewhat tapering, distal half very densely striate, b_2 subcylindrical, tapering distally, striate, somewhat diverging. b_1 1.1 times as long as interdistance, b_2 as long as distance $b_1 - b_2$.

Anal plate large, 1.1 times as broad as long, narrowest anteriorly, with large lateral corners and rounded posterior margin; two widely separated, subcylindrical appendages protruding from posterosternal side of lateral corners, appendages strongly diverging, curved inward, appendages and posterior part of plate distinctly pubescent, lateral parts with shorter hairs. Posteromedian part of sternum pubescent.

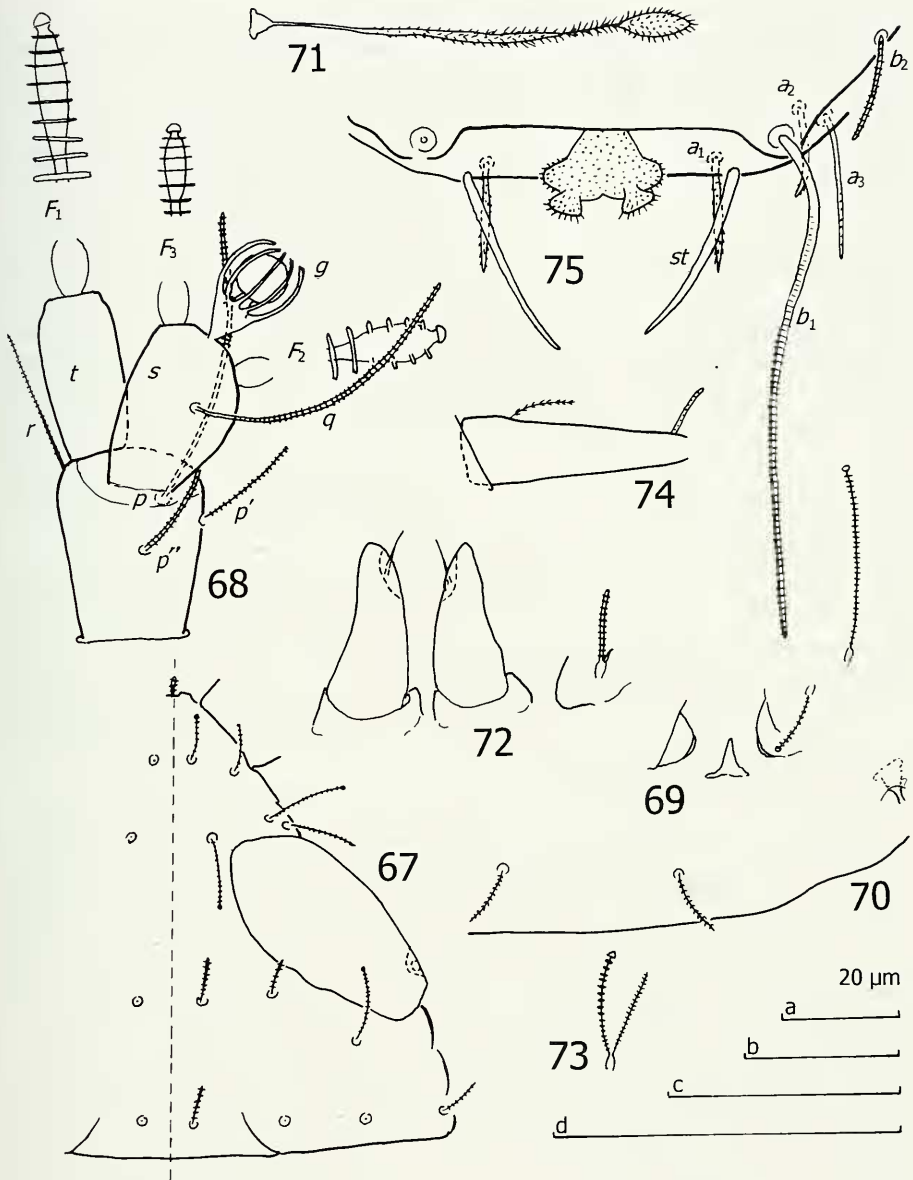
14. *Allopauropus (D.) bakoensis* sp. n.

Figs 67-75

TYPE MATERIAL: Holotype: ad. 9(♀), Malaysia, Sarawak, Bako National Park, Jalan Lintang, soil sample (extraction in Geneva) from between buttresses of *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae), alt. 30 m, 11.XII.1987 (loc. Sar-87/76, leg. Hauser). Paratypes: Malaysia: Sarawak: Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m. 2 ad. 9(♂, ♀), 8.XII.1987 (loc. Sar-87/60, leg. Hauser). - Altogether 3 specimens.

ETYMOLOGY: A latinized adjective of the name Bako (referring Bako National Park).

DIAGNOSIS: An anal plate similar to that in *A. (D.) bakoensis* sp. n. has not been found in other species of the genus and is, together with the unusually long *st* and the T_3 with distal swelling, delimiting this species. Its relationships cannot be traced at present.



FIGS 67-75

Allopauopus (D.) bakoensis sp. n., holotype, ad. ♀. (67) head and anterior part of tergite I, right part, tergal view; (68) right antenna, sternal view; (69) collum segment, median and left part, sternal view; (70) tergite VI, posteromedian part and right posterior corner; (71) T_3 ; (72) genital papillae and seta on coxa of leg 2, anterior view; (73) seta on coxa of leg 9; (74) tarsus of leg 9; (75) pygidium, posteromedian and left part, sternal view. Scale a: Fig. 67; b: Figs 69, 71-74; c: Figs 70, 75; d: Fig. 68.

DESCRIPTION: *Length* = 0.51(-0.53) mm.

Head (Fig. 67): Tergal setae thin, striate. Relative lengths of setae (holotype only), 1st row: $a_1 = a_2 = 10$; 2nd row: $a_1 = a_3 = 15$, $a_2 = 19$; 3rd row: $a_1 = 10$, $a_2 = 8$; 4th row: $a_1 = 9$, a_2 and $a_3 = ?$, $a_4 = 10$; lateral group: $l_1 = 15$, $l_2 = 19$, $l_3 = ?$. Ratio $a_1/a_1 - a_1$ in 1st row 1.1, 2nd row 0.9, 3rd row 0.7, 4th row 0.8. Temporal organs twice longer than shortest interdistance; small pistil present in posterior part. Head cuticle glabrous.

Antennae (Fig. 68): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae striate, p , p' , p'' cylindrical, blunt, r tapering. Relative lengths of setae: $p = 100$, $p' = (35-)37$, $p'' = (30-)32(-33)$, $r = (51-)53$. Tergal seta p 1.9 times as long as tergal branch t . The latter fusiform, (1.8-)-1.9 times as long as greatest diameter and 0.9 of length of sternal branch s , this twice longer than greatest diameter and with anterodistal corner distinctly truncate. Seta q long, cylindrical, striate, 1.8(-1.9) times as long as length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = (5-)-6$; $F_2 = 39(-44)$, $bs_2 = 2$; $F_3 = (82-)-85$, $bs_3 = 5$. F_1 (6.0-)-6.1 times as long as t , F_2 and F_3 2.2(-2.4) and 4.7(-4.9) times as long as s , respectively. Distal calyces hemispherical and distal part of flagella axes fusiformly widened, strongest in F_2 . Globulus g (1.4-)-1.5 times as long as wide and its width (0.9-) as long as greatest diameter of t ; ≈ 8 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 69) simple, cylindrical, blunt, annulate. Sublateral seta (2.7-)-2.8 times as long as submedian seta; sternite process small, narrow anteriorly and without apical incision; appendages short, hemispherical, with small caps. Both process and appendages glabrous.

Setae on tergites short, thin, striate; 4+4 setae on tergite I, 6+6 on II-V, and 4+2 on VI. Posterior setae on tergite VI (Fig. 70) 0.4(-0.5) of interdistance and about 0.6(-0.7) of length of pygidial setae a_1 .

Bothriotricha: Relative lengths (holotype only): $T_1 = 100$, $T_2 = 97$, $T_3 = 83$, $T_4 = 93$, $T_5 = 140$. All with straight, simple axes, all but T_3 very thin. Axis of T_3 (Fig. 71) thickest in the middle, subdistally thin and with distal swelling, this twice longer than wide and almost 0.2 of length of bothriotrix. Pubescence short, thin, almost vertically erect except on T_3 ; the latter with coarse hairs, oblique on axis, erect on endswelling.

Genital papillae (Fig. 72, of paratype): Proximal half subcylindrical, with concave outer side distally, 2.2 times as long as greatest diameter, glabrous; distal seta short, thin, 0.3 of length of papilla. Seta on coxa of leg 2 furcate, main branch cylindrical blunt striate, secondary branch rudimentary, pointed, glabrous.

Legs: Setae on coxa (Fig. 73) and trochanter of leg 9 furcate, branches thin, cylindrical, striate, secondary branch somewhat thinner than primary branch. Corresponding setae on more anterior legs with rudimentary secondary branch. Tarsus of leg 9 (Fig. 74) tapering, 3.3(-3.6) times as long as greatest diameter. Proximal seta somewhat curved, tapering, pointed, with distinct pubescence; distal seta almost straight, cylindrical, blunt, striate. Proximal seta (0.2-)-0.3 of length of tarsus and as long as distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 75): *Tergum*. Posterior margin between st straight. Relative lengths of setae: $a_1 = 10$, $a_2 = (7-)-8$, $a_3 = 13(-14)$, $st = 17(-19)$. Setae a_1 , a_2 and a_3 , thin, cylindrical, tapering, directed posteriorly, a_1 also straight, with short pubescence, a_2 somewhat curved inward, a_3 somewhat curved inward and with faint pubescence

distally; *st* tapering, somewhat curved inward, converging, glabrous. Distance $a_1 - a_1$ 2.0(-2.1) times as long as a_1 , distance $a_1 - a_2$ 0.3 of distance $a_1 - a_1$ and 3 times longer than distance $a_2 - a_3$; distance $st - st$ 1.4(-1.5) times as long as *st* and 1.2(-1.3) times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Setae b_1 on small but distinct posterior lobes, margin between lobes straight. Relative lengths of setae ($a_1 = 10$): $b_1 = (39-)$ 44, $b_2 = 10(-)$ 11). Setae striate, b_1 tapering, b_2 cylindrical, somewhat curved inwards. b_1 1.4(-1.5) times as long as interdistance; b_2 0.8 of distance $b_1 - b_2$.

Anal plate narrowest anteriorly, anterior part of lateral margins somewhat concave, distal part convex, forming lateral rounded lobes at broadest part; posterior margin with shallow median indentation; plate 1.8 times as broad as long. Two appendages, protruding posteriorly from hindmost part of sternal side; appendages 0.5 of the length of plate, thick, flattened distally, somewhat diverging. Plate with appendages distinctly pubescent, hairs longest on distal part of appendages; sternum glabrous.

15. *Allopaupopus (D.) crassatus* sp. n.

Figs 76-81

TYPE MATERIAL: Holotype: ad. 9(♀), Malaysia, Sarawak, Bau, near "Fairy Cave I", soil sample (extraction in Geneva) from between buttresses of large trees, alt. 20 m, 13.XII.1987 (loc. Sar-87/82, leg. Hauser). Paratypes: Malaysia, Sarawak, Serian District, Penrissen Road. 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction in Kuching) from between buttresses of large trees, alt. 50 m, 1 ad. 9(♀), 8.XII.1987 (loc. Sar-87/60, leg. Hauser). Gunung Serapi at road Kuching-Matang, soil sample (extraction in Kuching) in forest at the road to the television station, alt. 670 m, 2 subad. 8(♀), 9.XII.1987 (loc. Sar-87/64, leg. Hauser).

OTHER MATERIAL: Same data as for holotype, 1 juv. stad.?. – Altogether 5 specimens.

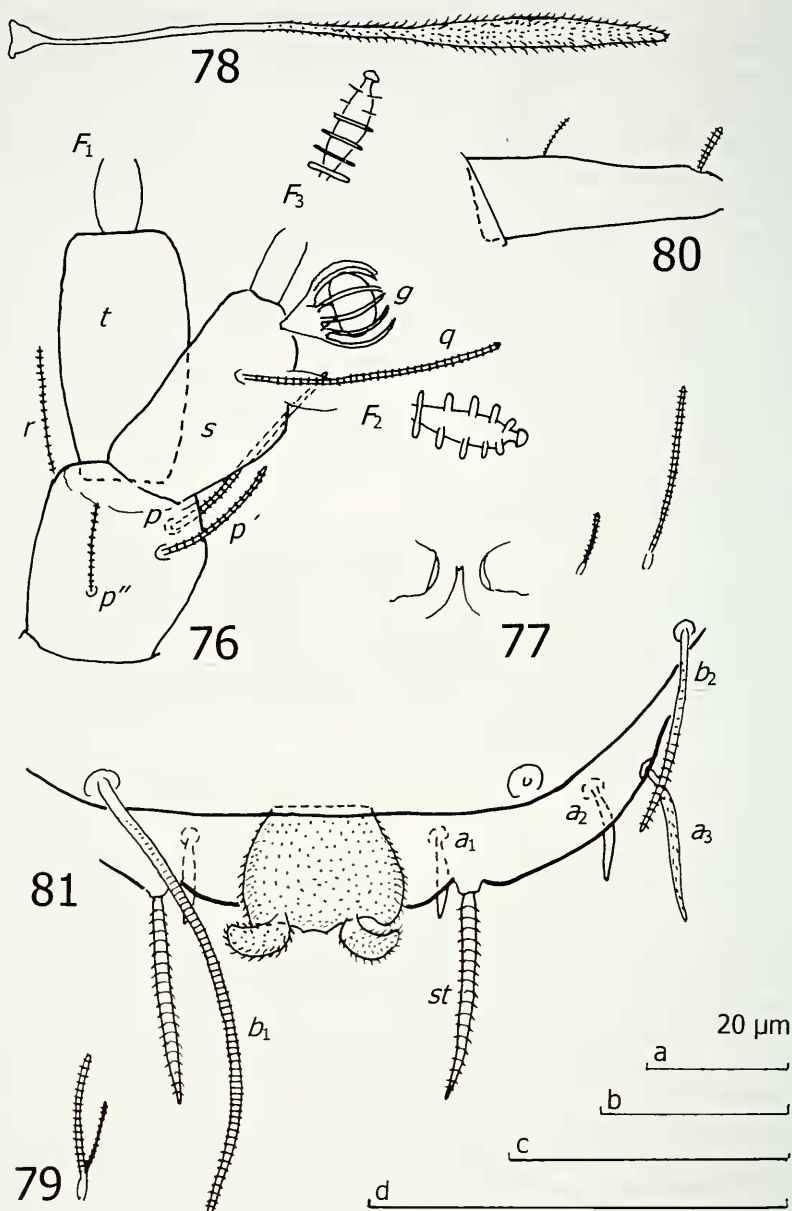
ETYMOLOGY: From the Latin *crassus* = thick; here meaning thickened (referring to T_3 , *st* and anal plate).

DIAGNOSIS: *A. (D.) crassatus* sp. n. is a close relative of *A. (D.) bakoensis* sp. n. described above. Distinctive characters are: the shape of the bothriotricha T_3 (with longish endswelling, almost half of length of bothriotrix in *A. crassatus* sp. n., about 0.2 of that length in *A. bakoensis* sp. n.), the *st* (directed posteriorly and sparsely striate in *A. crassatus* sp. n., converging and glabrous in *A. bakoensis* sp. n.) and the shape of the anal plate (lateral margins convex and posterior appendages sickle-shaped in *A. crassatus* sp. n., lateral margins concave and posterior appendages with flattened distal surface in *A. bakoensis* sp. n.). Due to similarities in the antennae, the bothriotricha T_3 , the legs and the general shape of the anal plate *A. crassatus* sp. n. may also be related, but to a less degree, to *A. (D.) thailandensis* Scheller from the Chiang Mai Province in northern Thailand (Scheller, 1995).

DESCRIPTION: *Length* = (0.32-)0.35(-0.39) mm.

Head: Not available for study.

Antennae (Fig. 76): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae cylindrical, striate. Relative lengths of setae: $p = 100$, $p' = 63(-)$ 78, $p'' = 68(-)$ 73, $r = (54)$ 58. Tergal seta p 0.9 of the length of tergal branch t . The latter fusiform, 1.7 times as long as its greatest diameter and 1.1 times as long as sternal branch s , this 1.7(-1.8) times as long as its greatest diameter and with its anterodistal corner distinctly



FIGS 76-81

Allopauropus (D.) crassatus sp. n., holotype ad. 9(♀). (76) right antenna, sternal view; (77) collum segment, median and left part, sternal view; (78) T_3 ; (79) seta on trochanter of leg 9; (80) tarsus of leg 9; (81) pygidium, sternal view. Scale a: Figs 79, 80; b: Fig. 77; c: Figs 78, 81; d: Fig. 76.

truncate. Seta q , cylindrical, striate, (1.1-)1.2 times as long as length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = (100)$, $bs_1 = (3-5)$; $F_2 = (35-41)$, $bs_2 = (3-5)$; $F_3 = (82-91)$, $bs_3 = (5-6)$. F_1 (4.8-5.4) times as long as t , F_2 and F_3 (1.9-2.1) and (4.2-4.6) times as long as s , respectively. Distal calyces hemispherical, distal part of flagella axes fusiformly widened. Globulus g 1.3(-1.4) times as long as wide and its width 0.6(-0.7) of greatest diameter of t ; ≈ 9 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 77) thin, simple, cylindrical, blunt, striate. Sublateral seta (2.8-)2.9 times as long as submedian seta; sternite process narrow, with extremely small anterior incision; appendages somewhat barrel-shaped, caps low. Process and appendages glabrous.

Setae on tergites short, thin, striate; 4+4 setae on tergite I, 6+6 on II-V, and 4+2 on VI.

Bothriotricha: Relative lengths (for holotype only): $T_1 = 100$, $T_2 = ?$, $T_3 = 78$, $T_4 = 98$, $T_5 = 170$. All with straight, simple axes, all but T_3 very thin. Axis of T_3 widening outward into a longish distal swelling, thickest in the middle, 0.4 of length of bothriotrix. Pubescence very short, thin, almost erect except on T_3 ; the latter (Fig. 78) with coarse oblique hairs.

Legs: Setae on coxa and trochanter (Fig. 79) of leg 9, furcate, branches thin, cylindrical, striate, secondary branch at least on trochanter shorter than main branch. Corresponding setae on more anterior legs simple. Tarsus of leg 9 (Fig. 80) somewhat tapering, 3 times longer than greatest diameter. Setae cylindrical, striate, proximal seta somewhat curved and a little thinner than distal seta, the latter straight, blunt. Proximal seta almost 0.2 of length of tarsus and 0.8(-0.9) of length of distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 81): *Tergum*. Posterior margin rounded and with broad lobe between st , lobe about 4 times broader than long and not protruding. Relative lengths of setae: $a_1 = 10$, $a_2 = (12-)$ 13, $a_3 = (18-)$ 20(-21), $st = (25-)$ 27(-29). Setae tapering, a_1 , a_2 and a_3 with short pubescence, a_1 also straight, directed posteriorly, a_2 also curved inward and directed posteriorly, a_3 also curved inward and diverging, st almost straight, directed posteriorly, sparsely striate. Distance $a_1 - a_1$ 3.3(-3.4) times as long as a_1 , distance $a_1 - a_2$ 0.6 of distance $a_1 - a_1$ and 3 times longer than distance $a_2 - a_3$; distance $st - st$ (1.4-)1.5 times as long as st and 1.2 times as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 straight. Relative lengths of setae ($a_1 = 10$): $b_1 = (60-)$ 64, $b_2 = 20(-22)$. Setae very little tapering, striate, b_2 somewhat curved inward, converging. b_1 1.2(-1.3) times as long as interdistance; b_2 0.7 of distance $b_1 - b_2$.

Anal plate narrowest anteriorly, anterior part of lateral margins straight, posterior part convex; broadest part at middle, 1.4 times as broad as long; posterior margin with two shallow median indentations inside posterolateral corners. Two appendages protruding posteriorly from hindmost part of sternal side inside the indentations, appendages 0.5 of length of plate, thick, sickle-shaped, diverging. Plate with appendages distinctly pubescent, hairs longest at lateral margins of plate and on appendages. Sternum glabrous.

Stage subad. 8. Tergite V with 6+4 setae. Setae in posterior row short, lanceolate, with oblique pubescence.

16. *Allopauropus (D.) curtus* sp. n.

Figs 82-89

TYPE MATERIAL: Holotype: subad. 8(♀), Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m, 1 ad. subad. 8(♀), 8.XII.1987 (loc. Sar-87/60, leg. Hauser).

DIAGNOSIS: *A. (D.) curtus* sp. n. seems to be most closely related to *A. (D.) adjacens* Remy from the Cape Province, South Africa, (Remy, 1956b) and *A. (D.) hortulanus* Remy from Pondichéry (Remy, 1961). They have distinct similarities in the general shape of the bothriotricha T_3 and the anal plate. The following characters are useful for distinguishing these species: the shape of the axis of bothriotricha T_3 (with short ovoid swelling in the middle in *A. curtus* sp. n., swelling very longish in *A. adjacens*, large clavate swelling in *A. hortulanus*), and the shape of the pygidial setae *st* (long, distally both widened and cut obliquely in *A. curtus* sp. n., subcylindrical and blunt in *A. adjacens* and *A. hortulanus*).

ETYMOLOGY: From the Latin *curtus* = truncated (referring to the distal part of pygidial setae *st*).

DESCRIPTION: *Length* = 0.45 mm.

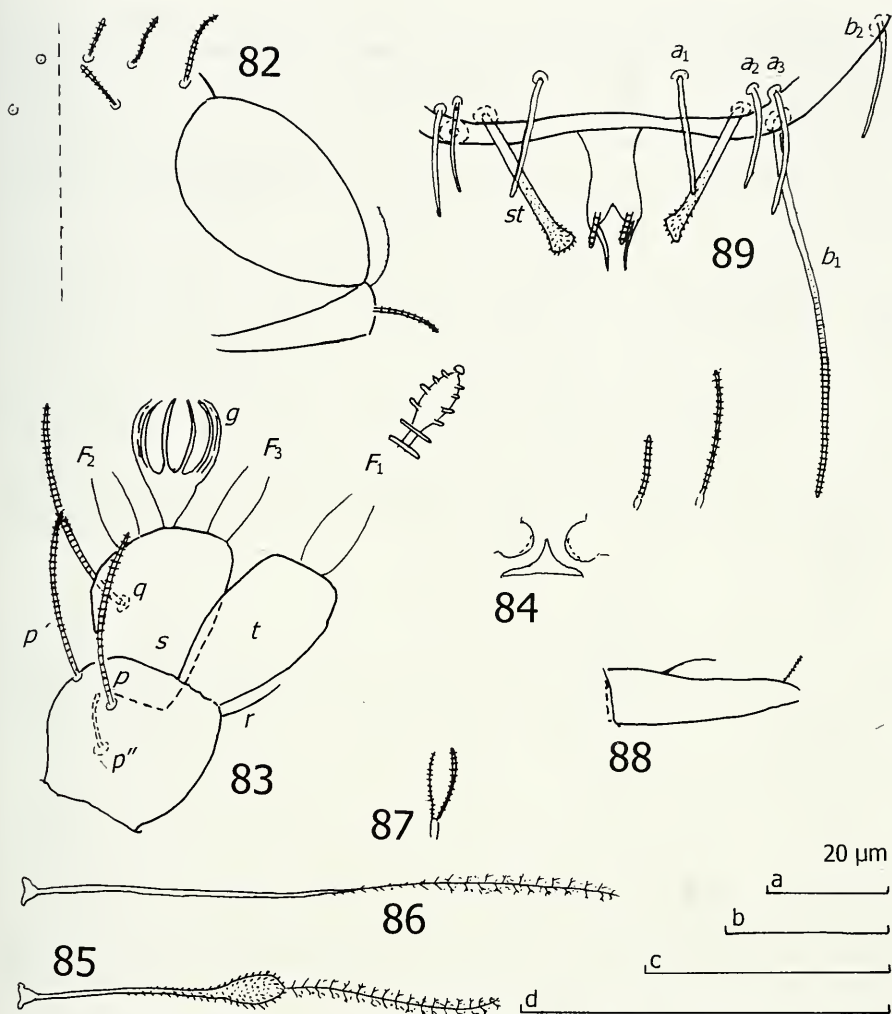
Head (Fig. 82): Posteromedian part of tergal side not available for study. Setae thin, striate. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 13$; 2nd row: $a_1 = 13$, $a_2 = 20$, $a_3 = ?$, 3rd row and first 3 setae in 4th row not available for study, a_4 in 4th row = 15; lateral group: $l_1 = 20$, l_2 and $l_3 = ?$. Ratio $a_1/a_1 - a_1$ in 1st row 0.9 and in 2nd row 0.5. Temporal organs 1.1 times as long as their shortest interdistance. Head cuticle glabrous.

Antennae (Fig. 83): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae thin, tapering, p , p' , p'' striate. r glabrous. Relative lengths of setae: $p = 100$, $p' = 92$, $p'' = 29$, $r = 42$. Tergal seta p 1.2 times as long as tergal branch t . The latter fusiform, 1.7 times as long as greatest diameter and 0.9 of length of sternal branch s , this 1.4 times as long as greatest diameter and with anterodistal corner distinctly truncate. Seta q thin, cylindrical, striate, 1.2 times as long as length of s . Lengths of $F_1 = 44$, $bs_1 = 5.5 \mu\text{m}$ (F_2 and F_3 lost). F_1 4.4 times as long as t . Distal calyx of F_1 very small, distal part of flagella axis distinctly widened. Globulus g 1.4 times as long as wide and its width as long as greatest diameter of t ; ≈ 9 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 84) simple, cylindrical, blunt, annulate. Sublateral seta 1.7 times as long as submedian seta; sternite process small, pointed anteriorly; appendages small, with low caps. Process and appendages glabrous.

Setae on tergites thin, striate; 4+4 setae on tergite I, 6+6 on II-V, and 4+2 on VI. Posterior setae on tergite VI not available for study.

Bothriotricha (Figs 85-86): Relative lengths: $T_1 = 100$, $T_2 = ?$, $T_3 = 94$, $T_4 = ?$, $T_5 = 115$. All with straight simple axes, all thin except T_3 . The latter with clavate proximal half, distal half very thin. Pubescence short oblique on clavate part of T_3 , longer, erect, arranged in whirls on distal part of other bothriotricha studied.



FIGS 82-89

Allopaupopus (D.) curtus sp. n., holotype, subad. 8 (♀). (82) head, anterior and right side, tergal view; (83) right antenna, tergal view; (84) collum segment, median and left part, sternal view; (85) T_3 ; (86) T_5 ; (87) seta on coxa of leg 8; (88) tarsus of leg 8; (89) pygidium, posteromedian and right part, tergal view. Scale a: Figs 85-88; b: Figs 82, 84; c: Fig. 89; d: Fig. 83.

Legs: Setae on coxa (Fig. 87) and trochanter of leg 8 furcate, branches similar to each other, thin, cylindrical, striate. Corresponding setae on more anterior legs with rudimentary secondary branch, coxal setae somewhat clavate. Tarsus of leg 8 (Fig. 88) tapering, 3.4 times as long as greatest diameter. Distal seta straight, cylindrical, blunt, striate; proximal seta curved, tapering, pointed, glabrous. Proximal seta 0.3 of length of tarsus and twice longer than distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 89): *Tergum*. Posterior margin with shallow indentation between *st*. Relative lengths of setae: $a_1 = a_3 = 10$, $a_2 = 8$, $st = 12$. Setae a_1 , a_2 and a_3 , cylindrical, glabrous, a_1 , also straight, somewhat diverging, a_2 and a_3 somewhat curved inward; *st* straight, converging, somewhat widening outward, distal end obliquely truncate, flattened, proximal half glabrous, distal half with short pubescence. Distance $a_1 - a_1$ 1.1 times as long as a_1 , distance $a_1 - a_2$ 4 times longer than distance $a_2 - a_3$; distance $st - st$ 1.8 times as long as *st* and 1.9 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin with shallow indentation between setae b_1 . Relative lengths of setae ($a_1 = 10$): $b_1 = 32$, $b_2 = 10$. Setae thin, somewhat tapering, b_1 densely striate distally, b_2 glabrous. b_1 1.2 times as long as interdistance; b_2 0.8 of distance $b_1 - b_2$.

Anal plate 1.8 times as long as broad, lateral margins concave, posterior part bilobate, lobes rounded, diverging. Four appendages protruding backwards from hindmost part of lobes: two in tergal position, short, cylindrical, blunt, striate, and two protruding from sternal side, thin, tapering, pointed, glabrous, somewhat converging. Tergal appendages 0.4 and sternal appendages 0.5 of length of plate. Plate and sternum glabrous.

17. *Allopauropus* (*D.*) *quadrispinus* sp. n.

Figs 90-96

TYPE MATERIAL: Holotype: ad. ♀, Indonesia, Bali, Ubud, "Monkey Forest", at the curve in the road through the forest, under stones on slope, alt. 200 m, 30.XI.1987 (loc. Sar-87/37, leg. Hauser).

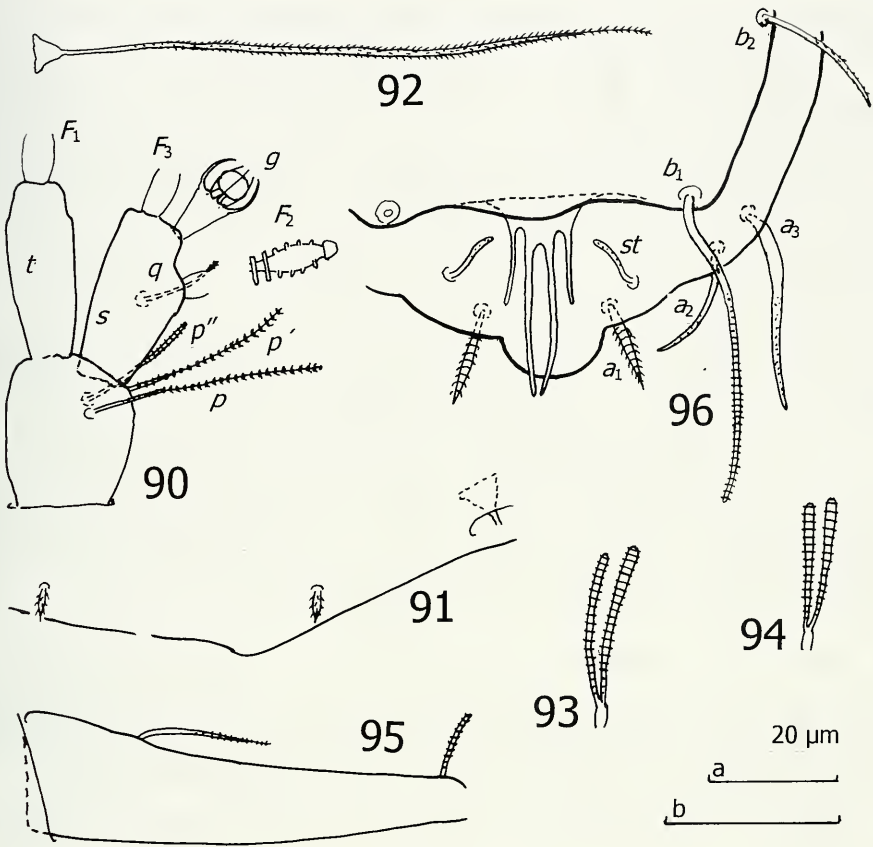
ETYMOLOGY: From the Latin quadric-, from quattuor = four and spina = spine, jag (referring to the anal plate).

DIAGNOSIS: *A. (D.) quadrispinus* sp. n. may be most closely related to *A. (D.) vinsoni* Remy from Mauritius (Remy, 1959). The anal plates have the same groundplan and the setae of the pygidial tergum are similar. Both species can be distinguished by the shape of the posterior margin of the tergum (with distinct posteromedian lobe in *A. quadrispinus* sp. n., no lobe in *A. vinsoni*) and by the shape of the anal plate (submedian appendages 3.5 times as long as plate and no sternal appendages in *A. quadrispinus* sp. n., 2.3 times as long as plate and with two short sternal appendages in *A. vinsoni*).

DESCRIPTION: *Length* = 0.82 mm.

Head: Not available for detailed study, anterior setae clavate, posterior ones cylindrical.

Antennae (Fig. 90): Segment 4 with at least 3 setae, p , p' , p'' , r and p''' not ascertained. Setae cylindrical, annulate-striate. Relative lengths of setae: $p = 100$, $p' = 71$, $p'' = 54$. Tergal seta p 1.4 times as long as tergal branch t . The latter fusiform, 2.5 times as long as greatest diameter and as long as sternal branch s , this 1.8 times as long as greatest diameter and with its anterodistal corner distinctly truncate. Seta q thin, striate, at least 0.5 of length of s . Flagella F_1 and F_3 broken, only base segments remaining; length of base segments of $F_1 = 5.5 \mu\text{m}$, those of $F_3 = 5 \mu\text{m}$, length of flagella $F_2 = 56 \mu\text{m}$ and its base segment = $3 \mu\text{m}$. F_2 2.8 times as long as s . Distal



FIGS 90-96

Allopauropus (D.) quadrispinus sp. n., holotype, ad. ♀. (90) left antenna, tergal view; (91) tergite VI, posterior part; (92) T_3 ; (93) seta on coxa of leg 9; (94) seta on trochanter of leg 9; (95) tarsus of leg 9; (96) pygidium, sternal view. Scale a: Figs 91-95; b: Figs 90, 96.

calyces F_2 hemispherical, distal part of flagella axes fusiformly widened. Globulus g 1.8 times as long as wide and its width 0.8 of greatest diameter of t ; ≈ 9 bracts present. Antennae glabrous.

Trunk: Collum segment not available for study. Setae on anterior tergites short, cylindrical, striate; on tergite VI 4+2 all short, lanceolate, pubescent; length of posterior setae on tergite VI (Fig. 91) 0.1 of interdistance.

Bothriotricha: Most bothriotricha broken off but seems to be very thin. Lengths: $T_3 = 98$, $T_5 = 130 \mu\text{m}$. Axes straight, simple, pubescence short, on T_3 (Fig. 92) longer, with oblique, simple hairs.

Legs: Setae on coxa (Fig. 93) and trochanter (Fig. 94) of leg 9, large, furcate, their branches subequal, subcylindrical, striate, blunt. Corresponding setae on leg 8 similar, on legs 1-7 main branches somewhat clavate, secondary branches rudimentary. Tarsus of leg 9 (Fig. 95) tapering, 4.3 times as long as its greatest diameter. Setae

striate, proximal seta tapering, pointed, distal seta cylindrical, blunt; the latter 0.3 of length of tarsus and 0.5 of length of distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 96): *Tergum*. Posterior margin with broad and low rounded lobe posterior of a_2 , this lobe with an extra median semicircular lobe protruding from between *st*. Relative lengths of setae: $a_1 = 10$, $a_2 = 14$, $a_3 = 22$, $st = 5$. Setae tapering, a_1 straight, lanceolate, diverging, striate; a_2 , a_3 and *st* subcylindrical, a_2 also thin, curved inward, converging, striate distally, a_3 also somewhat S-shaped, weakly pubescent distally, *st* somewhat S-shaped, thin, converging. Distance $a_1 - a_1$ 1.3 times as long as a_1 , distance $a_1 - a_2$ 2.2 times as long as distance $a_2 - a_3$; distance $st - st$ 3 times longer than *st* and 1.6 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin between b_1 with a low median bulge below anal plate and shallow indentations between bulge and insertion areas of b_1 . Relative lengths of setae ($a_1 = 10$): $b_1 = 34$, $b_2 = 15$. Setae tapering, striate distally, b_2 somewhat curved inward, diverging. b_1 1.1 times as long as interdistance; b_2 0.7 of distance $b_1 - b_2$.

Anal plate broadest at base, lateral margins concave, converging, posterior part with 4 long, thin, subparallel appendages protruding backward; submedian appendages longest, 3.5 times as long as plate, converging distally and with short pubescence there; lateral appendages 1.5 times as long as plate, glabrous, somewhat diverging distally. Plate with appendages and sternum glabrous.

18. *Allopauropus (D.) trapezoides* sp. n.

Figs 97-103

TYPE MATERIAL: Holotype: ad. 9(♂), Malaysia, Sarawak, Bako National Park, Jalan Lintang, soil sample (extraction in Geneva) from between buttresses of *Austrobuxus nitidus* Miq. [= *Longetia malayana* (Benth.) P. & H.] (Euphorbiaceae), alt. 30 m, 11.XII.1987 (loc. Sar-87/76, leg. Hauser). Paratype: same data as for holotype, 1 ad. 9(♀). - Altogether 2 specimens.

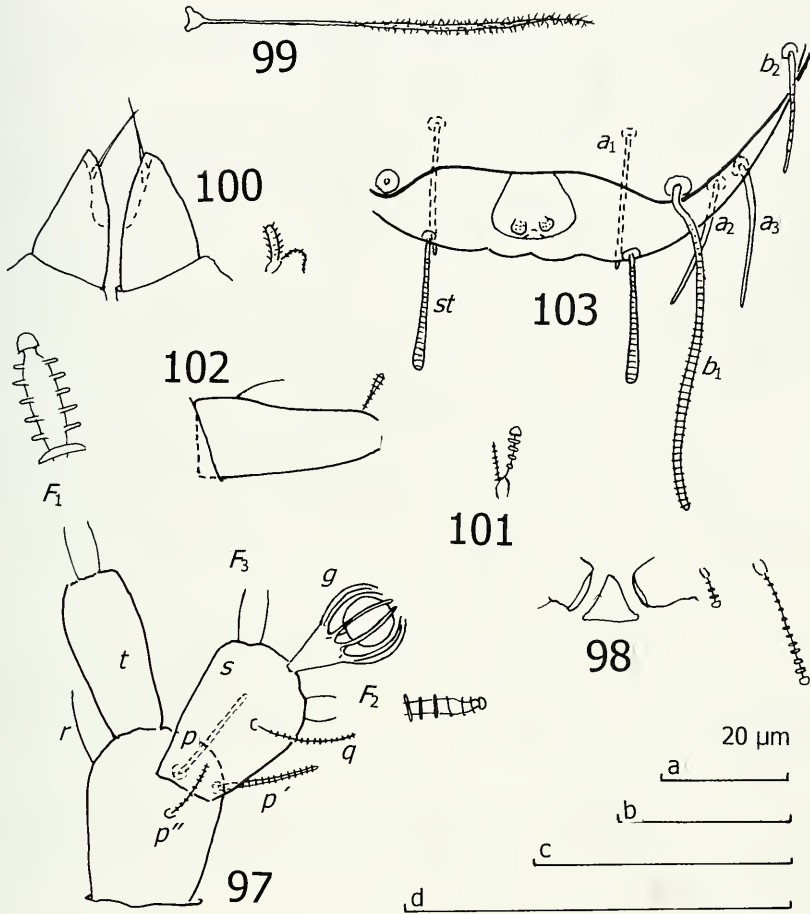
ETYMOLOGY: From the Latin trapezium = trapezium (referring to the shape of the anal plate).

DIAGNOSIS: *A. (D.) trapezoides* sp. n. is a very small species characterised by the following combination of characters not found in other species of the subgenus *Decapauropus*: antennal globulus proportionally large and with many bracts, setae of collum segment simple, annulate, with hemispherical endsegment, the T_3 with distinct pubescence of simple oblique-erect hairs, main branch of seta on coxa of leg 9 annulate with hemispherical endsegment, tarsi short, anal plate linguiform, with two short submedian appendages on distal part of sternal side.

DESCRIPTION: *Length* = 0.25(-0.30) mm.

Head: Not available for study.

Antennae (Fig. 97): Segment 4 with setae p , p' , p'' and r ; p''' not ascertained. Setae cylindrical, all but r striate, r very thin, glabrous. Relative lengths of setae (holotype only): $p = 100$, $p' = 92$, $p'' = 67$, $r = 77$. Tergal seta p 0.7 of length of tergal branch t . The latter somewhat fusiform, twice longer than greatest diameter and 0.9 of length of sternal branch s , this 1.4 times as long as greatest diameter and with anterodistal corner truncate. Seta q thin, cylindrical, blunt, densely striate, 0.9 of length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 7$; $F_2 = 47(-49)$, $bs_2 = 3(-4)$; $F_3 = (80-)$ 84, $bs_3 = 7$. F_1 5.0(-5.1) times as long as



FIGS 97-103

Allopauropus (D.) trapezoides sp. n., holotype, ad. 9 (♀). (97) right antenna, sternal view; (98) collum segment, median and left part, sternal view; (99) T_3 ; (100) genital papillae and seta on coxa of leg 2, anterior view; (101) seta on coxa of leg 9; (102) tarsus of leg 9; (103) pygidium, posterior and left part, sternal view. Scale a: Fig. 99; b: Figs 98, 100-102; c: Fig. 103; d: Fig. 97.

t , F_2 and F_3 2.2 and 4.0(-4.1) times as long as s , respectively. Distal part of F_2 with very small calyces, distal part of flagella axes cylindrically widened in F_1 , indistinctly widened in F_2 . Globulus g proportionally large, 1.5 times as long as wide, 0.7 of length of s and its width somewhat wider than greatest diameter of t ; at least 10 bracts present. Antennae glabrous.

Trunk: Setae of collum segment (Fig. 98) simple, somewhat clavate, annulate, with hemispherical endsegment. Sublateral seta 3 times longer than submedian seta; sternite process triangular, without anterior incision; appendages barrel-shaped, low, flat. Process and appendages glabrous. Setae on tergites not available for study.

Bothriotricha: Most bothriotricha broken off. Lengths: $T_2 = 60$, $T_3 = 60(62)$, $T_5 = 67(75)$ μm . Axes straight, thin. T_3 (Fig. 99) thickest, with distinct pubescence of simple, oblique - erect hairs.

Genital papillae (Fig. 100): Genital papillae conical, 1.8 times as long as greatest diameter, glabrous; distal seta thin, 0.8 of length of papilla.

Legs: Setae on coxa (Fig. 101) of leg 9 short, furcate, main branch clavate, annulate, apical segment hemispherical, secondary branch thin, somewhat shorter than main branch. Seta on trochanter and corresponding setae on more anterior legs not available for study, except on coxa of leg 2, seta there short, furcate, with branches subequal in length, main branch, cylindrical, striate, blunt, secondary branch thin, pointed, striate. Tarsus of leg 9 (Fig. 102) short tapering, 2.4(2.6) times as long as its greatest diameter. Proximal seta thin, somewhat curved, tapering distally, almost glabrous; distal seta somewhat clavate, striate. Proximal seta 0.3 of length of tarsus and 1.2 times as long as distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 103): *Tergum*. Posterior margin rounded, two small posterior submedian bulges between *st*. Relative lengths of setae: $a_1 = a_2 = st = 10$, $a_2 = (8)10$, $a_3 = (11)12$. Setae a_1 , a_2 and a_3 thin, cylindrical, glabrous, a_1 also straight, posteriorly directed, a_2 and a_3 somewhat curved inward, a_2 converging, a_3 directed backward; *st* straight, somewhat clavate, striate, directed posteriorly. Distance $a_1 - a_1$ (1.4)1.5 times as long as a_1 , distance $a_1 - a_2$ 2.3 times as long as distance $a_2 - a_3$; distance *st* - *st* 1.5 times as long as *st* and as long as distance $a_1 - a_1$. Tergum glabrous.

Sternum. Posterior margin between b_1 with broad shallow indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 25(27)$, $b_2 = 10(11)$. b_1 cylindrical, blunt, striate, b_2 tapering, somewhat curved inward. b_1 1.1 times as long as interdistance; b_2 0.7 of distance $b_1 - b_2$.

Anal plate narrowest at base, trapezoid, lateral margins somewhat convex, posterior margin rounded with small median indentation; two short, subglobular, submedian, diverging appendages protruding downward from posterior part of sternal side. Plate and sternum glabrous.

Genus *Rabaudauropus* Remy, 1953

19. *Rabaudauropus dispar* Scheller

Rabaudauropus dispar Scheller, 1994 (in Scheller *et al.*, 1994): 5-7, figs 20-30.

MATERIAL EXAMINED: Malaysia, Sarawak, Road Kuching-Serian, 18 km from Kuching, near Kampong Kuap, secondary forest, soil sample (extraction in Geneva) from between buttresses of a large tree, alt. 30 m, 1 juv., 13.XII.1987 (loc. Sar-87/86, leg. Hauser).

GENERAL DISTRIBUTION: The species was previously known from two sites in Sabah only (Scheller *et al.*, 1994).

Scleropauropodinae

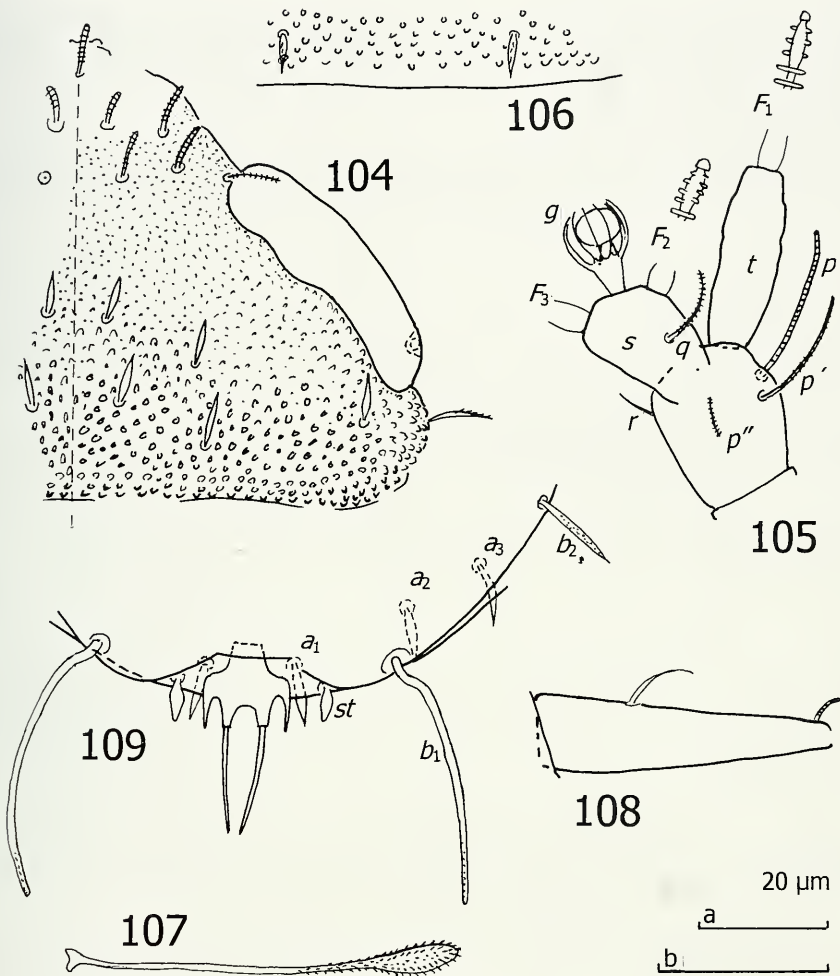
Genus *Scleropauropus* Silvestri, 1902

Subgenus *Scleropauropoides* Remy, 1957c

20. *Scleropauropus* (*S.*) *singapuranus* sp. n.

Figs 104-109

TYPE MATERIAL: Holotype: ad. 9(♀), Singapore, Botanical Garden, in the section "Jungle", under bark, alt. 25 m, 16.XII.1987 (loc. Sar-87/89, leg. Hauser).



FIGS 104-109

Sceloporpauropus (S.) singapuranus sp. n. holotype, ad. 9(♀). (104) head, median and right part, tergal view; (105) right antenna, sternal view; (106) tergite VI, posteromedian part; (107) T_3 ; (108) tarsus of leg 9; (109) pygidium, posteromedian and left part, sternal view. Scale a: Figs 104, 106-108; b: Figs 105, 109.

ETYMOLOGY: A latinized adjective of the name Singapura (Singapore).

DIAGNOSIS: Only four species have been described in this subgenus: *S. squameus* Remy from the Ivory Coast (Remy, 1948b), *S. mameti* Remy from Mauritius (Remy, 1959) and Sri Lanka (Scheller, 1970), *S. prunilis* Scheller from Sri Lanka (Scheller, 1970) and *S. quadrimamosus* Scheller from Thailand (Scheller, 1995). *S. singapuranus* sp. n. is closest to *S. mameti* but can be distinguished from that species by the shape of the setae of the 2nd row of the tergal side of the head (cylindrical and

striate in *S. singapuranus* sp. n., lanceolate, with pubescence in *S. mameti*) and by the shape of the temporal organs of the head (in tergal view of the same breadth in anterior and posterior parts in *S. singapuranus* sp. n., much broader in anterior part than posteriorly in *S. mameti*).

DESCRIPTION: *Length* = 0.76 mm.

Head (Fig. 104): Setae in the two anterior rows cylindrical, blunt, striate, in the two posterior rows lanceolate, glabrous or with indistinct pubescence. Relative lengths of setae, 1st row: $a_1 = 10$, $a_2 = 16$; 2nd row: $a_1 = a_2 = 14$, $a_3 = 20$, 3rd row: $a_1 = a_2 = 10$, 4th row: $a_1 = a_2 = a_3 = 15$, $a_4 = 20$; setae of lateral group tapering, pointed, with oblique pubescence: $l_1 = l_2 = 34$, $l_3 = 36$. Ratio $a_1/a_1 - a_1$ in 1st and 3rd rows 0.8, in 2nd and 4th rows 0.6. Temporal organs mainly in lateral position, length 0.9 of shortest interdistance. Head cuticle distinctly granular anteriorly and inside temporal organs, coarsely granular in posteromedian and posterolateral part.

Antennae (Fig. 105): Segment 4 with setae p , p' , p'' and r . Setae p , p' , p'' cylindrical, blunt, striate, r very thin, tapering, glabrous. Relative lengths of setae: $p = 100$, $p' = 83$, p'' and $r = 28$. Tergal seta p 0.8 of length of tergal branch t . The latter fusiform, 3.1 times as long as its greatest diameter and 1.2 times as long as sternal branch s , this 1.8 times as long as greatest diameter and with its anterodistal corner distinctly truncate. Seta q thin, tapering, striate, 0.6 of length of s . Relative lengths of flagella (basal segments included) and basal segments: $F_1 = 100$, $bs_1 = 5$; $F_2 = 57$, $bs_2 = 3$; $F_3 \approx 52$, $bs_3 = 5$. F_1 4.5 times as long as t , F_2 and F_3 3.1 and ≈ 2.8 times as long as s , respectively. Distal calyces small, hemispherical, distal part of flagella axis only slightly widened. Globulus g 1.3 times as long as wide and its width 1.1 times as long as greatest diameter of t ; ≈ 9 bracts present. Small posterior pistil in temporal organs. Antennae glabrous.

Trunk: Collum segment not available for study. Setae on tergites lanceolate, on anterior tergites glabrous, on posterior tergites with sparse oblique pubescence; 4+4 setae on tergite I, 6+6 on II-V, and 4+2 on VI. Posterior setae on tergite VI (Fig. 106) 0.2 of interdistance. All tergites with coarsely granular cuticle.

Bothriotricha: Relative lengths: $T_1 = 100$, $T_2 = 99$, $T_3 = 62$, $T_4 = 57$, $T_5 = 135$. All with straight simple axes, all thin except T_3 . The latter (Fig. 107) with thick axis and distal endswelling, 3.3 times as long as wide, 0.2 of length of bothriotrix. Pubescence on T_1 , T_2 , T_4 and T_5 short, erect distally, T_3 glabrous in proximal half, endswelling with distinct pubescence of short, simple, oblique hairs.

Legs: Setae on coxa and trochanter not available for study. Tarsus of leg 9 (Fig. 108) slender, tapering, 3.8 times as long as its greatest diameter. Setae curved, proximal seta tapering, pointed, glabrous, distal seta similar but not pointed. Proximal seta 0.3 of length of tarsus and 2.4 times as long as distal seta. Cuticle of tarsus glabrous.

Pygidium (Fig. 109): *Tergum*. Posterior margin evenly rounded. Relative lengths of setae: $a_1 = a_2 = a_3 = 10$, $st = 7$. Setae short, lanceolate, glabrous, a_1 , a_2 and a_3 also somewhat diverging, st directed posteriorly. Distance $a_1 - a_1$ 1.4 times as long as a_1 , distance $a_1 - a_2$ 0.5 of distance $a_2 - a_3$; distance $st - st$ 3.6 times as long as st and 1.8 times as long as distance $a_1 - a_1$. *Tergum* glabrous.

Sternum. Posterior margin between setae b_1 with two rounded bulges and a distinct median indentation. Relative lengths of setae ($a_1 = 10$): $b_1 = 43$, $b_2 = 14$. b_1 sub-

cylindrical, blunt, very densely striate most distally, directed downward, b_2 lanceolate; b_1 0.9 of interdistance; b_2 0.4 of distance $b_1 - b_2$.

Anal plate narrowest at base, with one pair of lateral lobes and one pair of submedian posterior lobes; lobes separated by U-shaped indentations; each lobe with a posteriorly directed, thin, tapering appendage. Appendages protruding from lateral lobes short, 0.3 of length of plate, appendages of posterior lobes 1.4 times as long as plate. Plate with appendages and sternum glabrous.

BRACHYPAUROPODIDAE

Genus *Brachypauropoides* Remy, 1952

21. *Brachypauropoides penanorum* Scheller

Brachypauropoides penanorum Scheller, 1994 (in: Scheller *et al.*, 1994): 8-11, figs 31-42.

MATERIAL EXAMINED: Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m, 1 juv. 3, 8.XII.1987 (loc. Sar-87/60, leg. Hauser).

GENERAL DISTRIBUTION: Previously known from a single locality in Sabah only (Scheller *et al.*, 1994).

EURYPAUROPODIDAE

Eurypauropodinae

Genus *Samarangopus* Verhoeff, 1934

22. *Samarangopus longipenes* Scheller

Samarangopus longipenes Scheller, 2001: 965-969, figs 39-53.

MATERIAL EXAMINED: Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m, 6 ad. 9 (♀), 8.XII.1987 (loc. Sar-87/60, leg. Hauser). – Altogether 6 specimens.

GENERAL DISTRIBUTION: The species was previously known from Sabah only (Scheller, 2001).

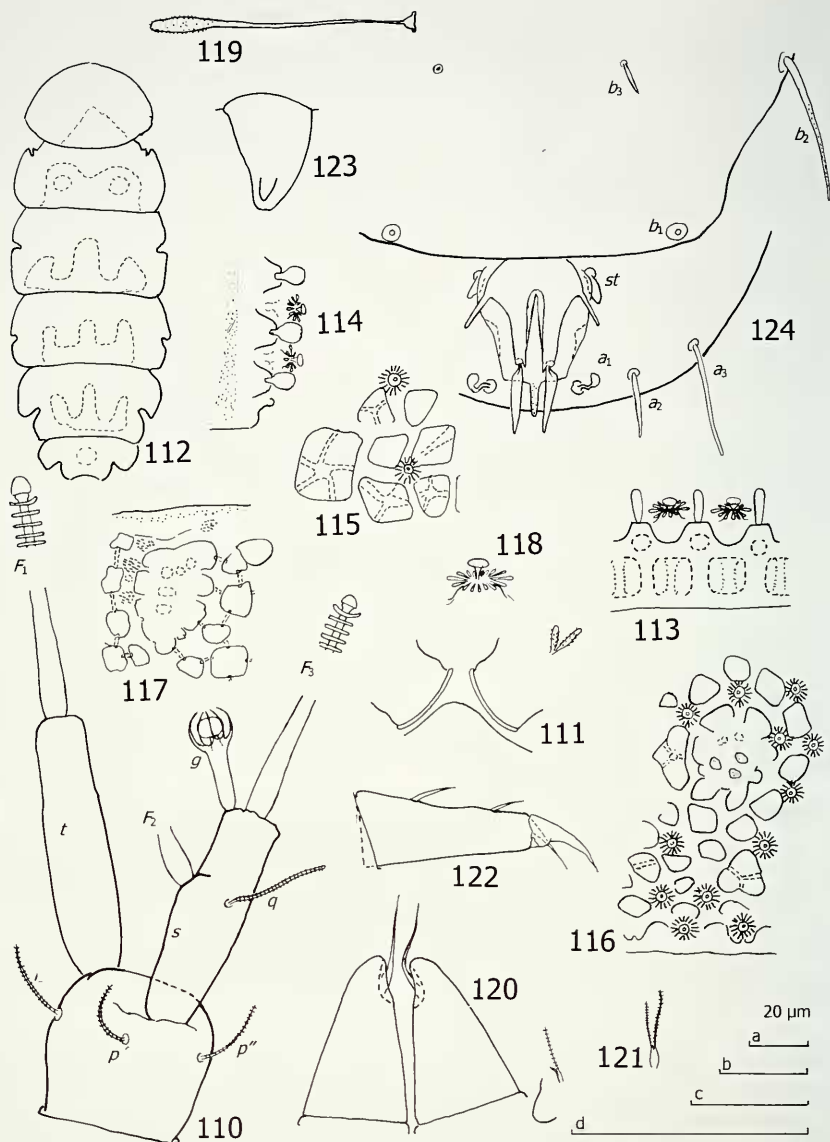
23. *Samarangopus trilix* sp. n.

Figs 110-124

TYPE MATERIAL: Holotype: ad 9 (♂), Malaysia, Sarawak, Serian District, Penrissen Road, 12 mls from Kuching, "Semongok Wildlife Rehabilitation Centre, Nursery Centre of the Forest Department", soil sample (extraction at Kuching) from between buttresses of large trees, alt. 50 m, 8.XII.1987 (loc. Sar-87/60, leg. Hauser).

ETYMOLOGY: From the Latin *trilix* = woven with three threads (referring to the cuticle of the tergites).

DIAGNOSIS: *S. trilix* sp. n. closely resembles *S. browni* Remy from New Caledonia (Remy, 1957b). Distinctive character are e.g., the shape of the stalk of the antennal globulus *g* (long and subcylindrical in *S. trilix* sp. n., shorter and conical in *S. browni*), the shape of the sternal antennal branch (3.2 times as long as greatest diameter in *S. trilix* sp. n., about 2.3 in *S. browni*) and the shape of setae b_3 of the



FIGS 110-124

Samarangopus trilix sp. n., holotype, ad. 9(♀). (110) left antenna, sternal view; (111) collum segment, median and left part, sternal view; (112) body, tergal view, tergites I-VI showing areas with concentration of funnel-shaped organs; (113) tergite I, anterior margin, sternal view showing marginal protuberances, internal latice and funnel-shaped organs; (114) tergite IV, lateral margin anterior of T_3 , tergal view; (115) tergite I, central part, cuticular pattern with internal latice and funnel shaped organs; (116) tergite II, right posterolateral part; (117) tergite III, central part, cuticular structures; (118) wart-like structure with funnel-shaped organ; (119) T_3 ; (120) genital papillae and seta on coxa of left leg 2; (121) seta on coxa of leg 9; (122) tarsus of leg 9; (123) femur of leg 1 with appendage; (124) pygidium, median and left part, sternal view. Scale a: Figs 121-122; b: Fig. 120; c: Figs 110-111, 113-117, 119, 123-124; d: Fig. 118.

pygidial sternum (glabrous and pointed, length 0.2 of interdistance in *S. trilix* sp. n., cylindrical, blunt, striate, 0.5 of interdistance in *S. browni*).

DESCRIPTION: *Length*. 1.56 mm.

Antennae (Fig. 110): Antennae glabrous; segment 4 with 3 tapering striate setae, their lengths 15 μm . Sternal branch *s* with shallow anterior indentation, anterior margin = 23 μm , posterior margin = 38 μm , \emptyset of base = 7 μm , maximum \emptyset = 12 μm , *q* thin, cylindrical, annulate-striate, *l* = 17 μm . Posterior margin/length of *g* 2.1, posterior margin/maximum \emptyset = 3.0, maximum \emptyset/\emptyset of base = 1.7. Tergal branch sub-cylindrical, *l* = 43 μm , \emptyset of base = 6 μm , maximum \emptyset = 11 μm ; pore not ascertained; length of *t*/maximum \emptyset = 3.9. Globulus *g*, *l* = 17 μm , maximum \emptyset = 8 μm ; length/maximum \emptyset = 2.1; number of bracts 9, their length = 7 μm , capsule subspherical, \emptyset = 4 μm . Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, $bs_1 = 22$, $F_2 = 87$, $bs_2 = 8$, $F_3 = ?$, $bs_3 = 22$. F_1 3 times longer than tergal branch *t*, F_2 3 times longer than sternal branch *s*. Calyces of F_1 largest, subhemispherical, those of F_2 and F_3 , hemispherical.

Trunk: Submedian setae of collum segment (Fig. 111) short, furcate, branches subcylindrical, with short pubescence, *l* = 6 μm . Sternite process broad, rounded anteriorly, no anterior incision. Appendages large but short, cylindrical, caps flat, somewhat larger than appendage itself. Process and appendages glabrous.

Tergites (Fig. 112): Tergite I with a single marginal row of short, somewhat clavate, glabrous protuberances (Fig. 113); lateral margins of other tergites (Fig. 114) with short spatulate protuberances. Cuticle thick, inner part of all tergites with cylindrical canals or supports around cavities in a complicated three-dimensional network (Figs 113, 115). Inner parts of tergites with surface structures of peculiar shape and unknown function (Figs 116-117). Cuticular surface near margins and especially on posterior parts of tergites with many wart-like structures with a small transparent funnel on top and a dense collar of small clavate transparent appendages surrounding its base (Fig. 118).

Length/width ratio of tergites: I = 0.6, II and IV = 0.4, III, V and VI = 0.5.

Bothriotricha: All bothriotricha but T_3 with very thin axes; these glabrous except for a minute pubescence on their distal third. T_3 (Fig. 119) with thicker axes and distal endswelling with weak pubescence. Relative lengths of bothriotricha: $T_1 = 100$, $T_2 = 106$, $T_3 = 50$, $T_4 = 94$, $T_5 = 82$.

Genital papillae (Fig. 120): Base segments cylindrical. Length of papillae = 56 μm , greatest \emptyset = 35 μm , length of seta = 20 μm . Proximal part of genital papillae subcylindrical, distal part conical, seta 0.4 of length of papilla, this 1.6 times as long as greatest diameter. Cuticle glabrous. Coxal seta of leg 2 as on leg 1, length = 20 μm .

Legs: All legs 5-segmented. Seta on coxa (Fig. 121) and trochanter of leg 9 similar to each other, thin, furcate, striate, with glabrous base; length of secondary branch 0.7 of primary one. More anteriorly these setae with rudimentary pointed glabrous secondary branches. Tarsi short, tapering, those of leg 9 (Fig. 122) 2.3 times as long as greatest diameter, with two tergal setae, both pointed and glabrous. Proximal seta 15 μm , distal one 10 μm . Proximal setae 0.3 of length of tarsus and 1.5 times as long as distal seta. Cuticle of tarsus glabrous. No proximal seta on tarsus of leg 1. All legs with large main claw and small setose anterior secondary claw; in leg 9 the former

reaching 0.5 of length of tarsus. A blunt glabrous appendage, length = 7 μm , on anterior side of femur of leg 1 (Fig. 123).

Pygidium (Fig. 124): *Tergum*. Posterior margin evenly rounded. Setae glabrous, a_1 very short, clavate, curved inward, diverging; a_2 and a_3 straight, cylindrical, posteriorly directed, somewhat diverging; st straight, broadly lanceolate, diverging. Lengths of setae: $a_1 = st = 6$, $a_2 = 12$, $a_3 = 20$ μm . Distance $a_1 - a_1 = 6$, $a_2 - a_2 = 34$, $a_3 - a_3 = 54$, $a_1 - a_2 = 9$, $a_2 - a_3 = 11$, $st - st = 19$ μm . Distance $a_1 - a_1$ as long as a_1 , distance $a_1 - a_2$ 0.8 of distance $a_2 - a_3$; distance $st - st$ 3.2 times as long as st and 0.8 of distance $a_1 - a_1$. Cuticle glabrous.

Sternum. Posterior margin between b_1 almost straight. Setae b_1 lost, b_2 tapering, pointed, distal 2/3 with short pubescence, b_3 lanceolate, glabrous. Lengths of setae: $b_2 = 25$, $b_3 = 7$ μm . Distance $b_1 - b_1 = 48$, $b_2 - b_2 = 85$, $b_3 - b_3 = 31$, $b_1 - b_2 = 68$, $b_2 - b_3 = 55$ μm . b_2 0.7 distance $b_1 - b_2$, b_3 0.2 of interdistance.

Anal plate 1.2 times as long as wide, widest in anterior third, broadest part forming indistinct lateral corners, from there two short, thin, cylindrical, blunt, glabrous appendages protruding obliquely backward; appendages 0.4 of length of plate; posterior 2/3 of plate divided into two tapering branches by a narrow V-shaped incision, each branch with two appendages: a submedian, very short, tapering, glabrous point, and outside it a stalked bladder, in sternal view similar to a knife-blade. The latter 0.6 of length of plate. Plate and sternum glabrous. A shield-shaped plate with digitiform posterior appendage protruding backward from between st .

24. *Samarangopus tuberosus* sp. n.

Figs 125-137

TYPE MATERIAL: Holotype: ad 9(♀), Singapore, Labrador Hill, dry forest, soil sample (extraction at Bogor, Java) from under trees with small buttresses, alt. 40 m, 21.XI.1987 (loc. Sar-87/1, leg. Hauser).

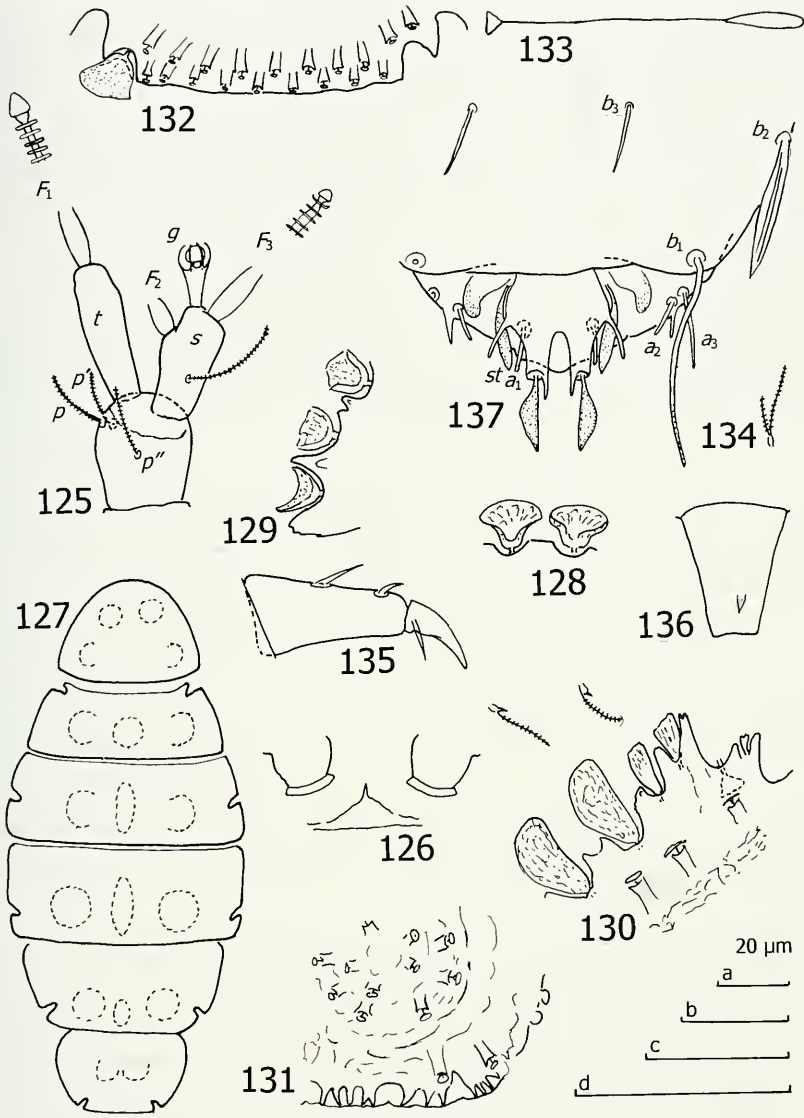
ETYMOLOGY: From the Latin *tuberosus* = full of protuberances, nodose (referring to the tergites).

DIAGNOSIS: *S. tuberosus* sp. n. is close to *S. segniter* Scheller from Sabah (Scheller *et al.*, 1994). Both have similar antennae, the same type of cuticular structures on the tergites and the pygidial setae b_2 are large and lanceolate. Distinguishing characters are: the shape of the distal part of the lateral protuberances of tergites I-V (cut almost squarely or rounded in *S. tuberosus* sp. n., triangular in *S. segniter*), the surface of T_3 (glabrous in *S. tuberosus* sp. n., with distinct pubescence in *S. segniter*), the length of the branches of the seta on the trochanter of leg 9 (primary branch twice longer than secondary branch in *S. tuberosus* sp. n., equal in length in *S. segniter*), the shape of the pygidial setae a_1 and st (a_1 straight and st large and lanceolate in *S. tuberosus* sp. n., a_1 curved inward and st short, cylindrical, blunt in *S. segniter*).

Other allied species are *S. umbraculus* Scheller and *S. spathaceus* Scheller from New Caledonia (Scheller, 1993), *S. poculifer* Scheller from Thailand (Scheller, 1995) and *S. jacobsoni* (Silvestri) from Java (Silvestri, 1930).

DESCRIPTION: Length = 0.80 mm.

Antennae (Fig. 125): Glabrous; segment 4 with 3 striate setae: p and p' cylindrical blunt, p'' tapering pointed, their lengths: p and $p'' = 10$ μm , $p' = 8$ μm . Sternal branch s : anterior margin = 11 μm , posterior margin = 14 μm , \emptyset of base = 7 μm .



FIGS 125-137

Samarangopus tuberosus sp. n., holotype, ad. ♀. (125) left antenna, sternal view; (126) collum segment, median and left part, sternal view; (127) body, tergal view, tergites I-VI showing areas with elevated cuticle; (128) tergite I, anterior marginal protuberances, sternal view; (129) tergite I, right posterolateral corner, sternal view; (130) tergite II, anterolateral corner at insertion area of T₁, marginal protuberances and cylindrical organs with umbrella-shaped top, tergal view; (131) tergite II, posterolateral corner with marginal protuberances and cylindrical organs with umbrella-shaped top, tergal view; (132) tergite VI, posterior part, tergal view; (133) T₃; (134) seta on coxa of leg 9; (135) tarsus of leg 9; (136) femur of leg I with appendage; (137) pygidium, median and left part, sternal view. Scale a: Fig. 132; b: Figs 128-131, 134-136; c: Figs 125-126, 133, 137; d: Fig. 134.

maximum $\emptyset = 9 \mu\text{m}$, q tapering, striate, $l = 17 \mu\text{m}$. Posterior margin/length of g 1.6, posterior margin/maximum $\emptyset = 1.6$, maximum \emptyset/\emptyset of base = 1.3. Tergal branch fusiform, $l = 29 \mu\text{m}$, \emptyset of base = $4 \mu\text{m}$, maximum $\emptyset = 6 \mu\text{m}$; pore not ascertained; length of t /maximum $\emptyset = 3.3$. Globulus g , $l = 9 \mu\text{m}$, maximum $\emptyset = 5 \mu\text{m}$; length/maximum $\emptyset = 1.8$; number of bracts 7, their length = $4 \mu\text{m}$, capsule subspherical, bottom somewhat flattened, $\emptyset = 3 \mu\text{m}$. Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, $bs_1 = 13$, $F_2 = 73$, $bs_2 = 7$, $F_3 = 58$, $bs_3 = 13$. F_1 3.6 times as long as tergal branch t , F_2 1.9 and F_3 3.4 times as long as sternal branch s , respectively. Calyces of F_1 largest, conical, those of F_2 and F_3 hemispherical.

Trunk: Submedian setae of collum segment (Fig. 126), furcate, main branch cylindrical and striate, secondary branch rudimentary, pointed, glabrous; submedian seta $l = 10 \mu\text{m}$, lateral seta $l = 9 \mu\text{m}$. Sternite process broad, pointed anteriorly. Appendages barrel-shaped, directed posteriorly, caps somewhat larger than distal part of appendage. Process glabrous, appendages almost so.

Tergites (Fig. 127): With 4 types of protuberances: 1. campanulate on anterior and lateral margins of tergite I (Figs 128-129); 2. wedge- or leaf-shaped on lateral margins of tergites II-VI (Fig. 130), these small or rudimentary at insertion cavities of bothriotricha; 3. smaller, cylindrical, cut squarely distally and with a small umbrella-like structure protruding from an apical cavity (Figs 130-132), these partly concentrated in groups on rounded elevations of the cuticle or in dense rows near margins of tergites; 4. Small, flat, blunt teeth in groups of 3-5 at posterior margins of tergites I-V (Fig. 131).

Number of marginal protuberances: I, 23; II, 1 small - T_1 - 9 (one smaller); III, 1 small - 3 - T_2 - 9; IV, 1 small - 4 - T_3 - 4; V, 1 small - 5 - T_4 - 1 small - 3; VI, 6 - T_5 - 1. Length/width ratio of tergites: I = 0.7, II-IV = 0.4, V = 0.5 and VI = 0.6.

Bothriotricha: All bothriotricha but T_3 with very thin axes; these glabrous, curled distally. T_3 (Fig. 133) with glabrous distal swelling, this 0.3 of length of bothriotrix. Relative lengths of bothriotricha: $T_1 = 100$, $T_2 = 96$, $T_3 = 54$, $T_4 = ?$, $T_5 = 78$.

Legs: All legs 5-segmented. Seta on coxa (Fig. 134) and trochanter of leg 9 similar to each other, thin, furcate, striate, with glabrous base: length of secondary branch 0.5 of primary one. More anteriorly these setae thinner and with rudimentary pointed glabrous secondary branches. Tarsi short, tapering, those of leg 9 (Fig. 135) twice longer than greatest diameter, with two tergal setae, both pointed and glabrous. Proximal seta 10, distal one $15 \mu\text{m}$. Proximal setae 0.3 of length of tarsus and twice longer than distal seta. Cuticle of tarsus glabrous. No proximal seta on tarsus of leg 1. All legs with large main claw and small setose anterior secondary claw; in leg 9 the former reaching 0.5 of length of tarsus. A pointed glabrous shortly pubescent appendage on anterior side of femur of leg 1 (Fig. 136), its length = $4 \mu\text{m}$.

Pygidium (Fig. 137): *Tergum*. Posterior margin rounded but with a pentagonal plate above anal plate protruding backward from between st , this plate narrowest anteriorly and with obtuse posterolateral corners. Two small posteriorly directed jags protrude backward at the level of setae a_2 . Setae glabrous, a_1 , a_2 and a_3 straight, cylindrical, glabrous, a_1 somewhat diverging, a_2 converging, a_3 straight, cylindrical, posteriorly directed; st lanceolate, curved inward, directed posteriorly. Lengths of

setae: $a_1 = 7 \mu\text{m}$, $a_2 = 5 \mu\text{m}$, $a_3 = 11 \mu\text{m}$, $st = 13 \mu\text{m}$. Distance $a_1 - a_1 = 10 \mu\text{m}$, $a_2 - a_2 = 30 \mu\text{m}$, $a_3 - a_3 = 35 \mu\text{m}$, $a_1 - a_2 = 12 \mu\text{m}$, $a_2 - a_3 = 2 \mu\text{m}$, $st - st = 13 \mu\text{m}$. Distance $a_1 - a_1$ 1.4 times as long as a_1 , distance $a_1 - a_2$ 6 times longer than $a_2 - a_3$; distance $st - st$ as long as st and 1.3 times as long as distance $a_1 - a_1$. Cuticle glabrous.

Sternum. Posterior margin between b_1 almost straight. Setae b_1 thin, tapering, striate most distally, b_2 large, lanceolate, with transparent wings, glabrous, b_3 tapering, pointed, striate most distally. Lengths of setae: $b_1 = 30 \mu\text{m}$, $b_2 = 20 \mu\text{m}$, $b_3 = 10 \mu\text{m}$. Distance $b_1 - b_1 = 39 \mu\text{m}$, $b_2 - b_2 = 130 \mu\text{m}$, $b_3 - b_3 = 22 \mu\text{m}$, $b_1 - b_2 = 21 \mu\text{m}$, $b_2 - b_3 = 22 \mu\text{m}$. b_2 as long as distance $b_1 - b_2$, b_3 0.4 of interdistance.

Anal plate 1.2 times as long as broad, broadest behind middle, lateral margins convex anteriorly, concave posteriorly; distal part cleft by a deep V-shaped incision into two tube-like branches; each branch with a short, submedian, straight, thorn-like, glabrous appendage, and a stalked leaf-shaped, knife-like posteriorly directed bladder, with granular surface, length of the latter appendage 0.7 of length of plate. Plate and sternum glabrous.

25. *Samarangopus interstinctus* sp. n.

Figs 138-150

TYPE MATERIAL: Holotype: ad 9(♂), Malaysia, Sarawak, Kuching-Matang road, Gunung Serapi, soil sample (extraction at Kuching) from forest along road to the TV-station, alt. 320 m, 9.XII.1987 (loc. Sar-87/66, leg. Hauser). Paratypes: 3 ad. 9(1♂, 2♀), 1 subad. 8(♀), same data as for holotype; 1 ad (♂), 1 subad. 8(♀), Kuching-Matang road, Gunung Serapi mountain, soil sample (extraction at Kuching) from forest along road to the TV-station, alt. 670 m, 9.XII.1987 (loc. Sar-87/64, leg. Hauser).

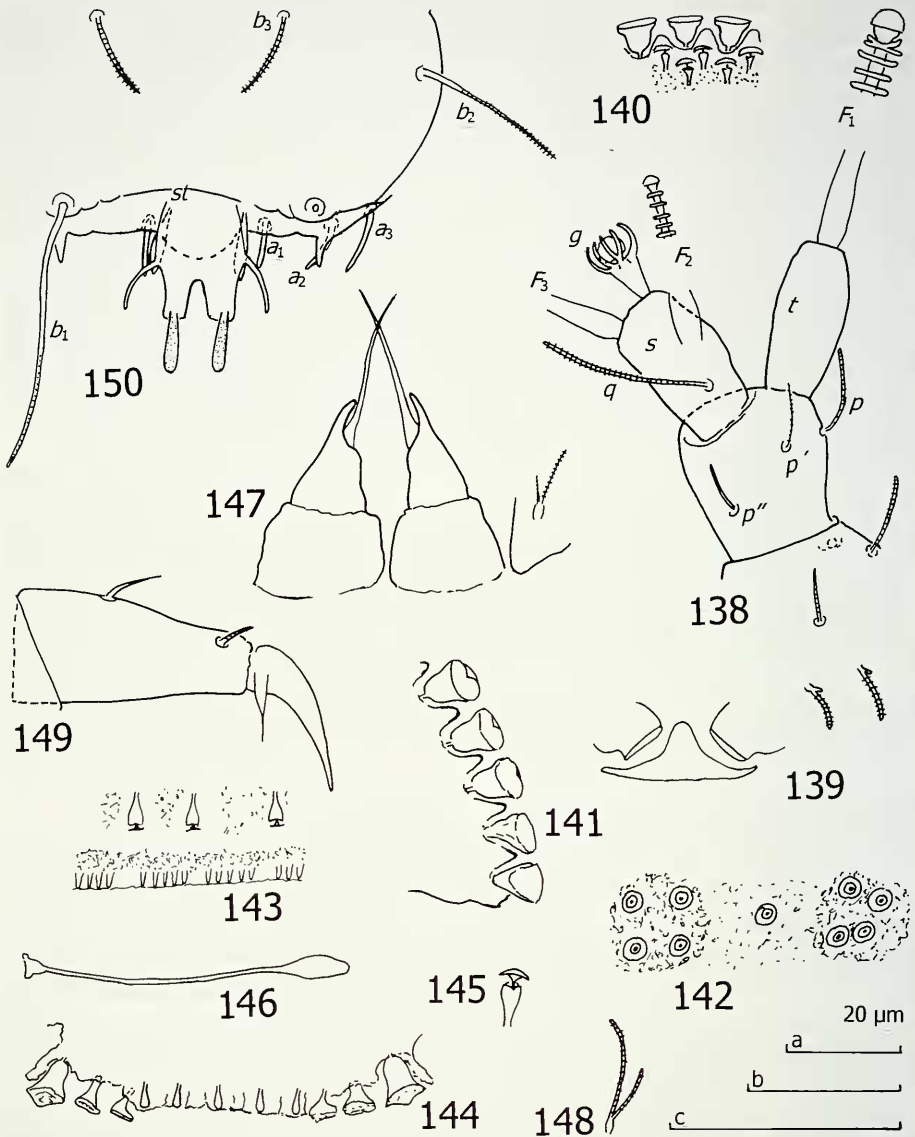
OTHER MATERIAL: Malaysia, Sarawak, Kuching-Serian road, near Kampong Kuap (18 km from Kuching), secondary forest, soil sample (extraction in Geneva) from between buttresses of a large tree, alt. 30 m, 6 ad. 9 (1♂, 5♀), 2 subad. 8(♀), 13.XII.1987 (loc. Sar-87/86, leg. Hauser). – Altogether 15 specimens.

ETYMOLOGY: From the Latin *interstinguo*, *interstinctus* = here and there bestrewed with (small fungiform organs on the tergites).

DIAGNOSIS: The species described here is close to *S. poculifer* Scheller from Thailand (Scheller, 1995). These two species are generally alike in their antennae, their cuticular appendages of the tergites and in the shape of the anal plate. They can be distinguished by the shape of the process of the collum segment (rounded anteriorly in *S. interstinctus* sp. n.; cleft anteriorly in *S. poculifer*), the shape of the protuberances of the anterior margin of tergite I (large and campanulate in *S. interstinctus* sp. n.; small and wedge-shaped in *S. poculifer*), by the shape of the specialised protuberances of the tergites (clavate central column with umbrella-like transparent covering disc in *S. interstinctus* sp. n.; funnel-like, consisting of a central column surrounded by a membrane in the shape of an upside down umbrella or a wide funnel in *S. poculifer*). Good distinctive characters are also found in the shape of the appendages of the postero-lateral corners of the pygidial tergum and its setae a_3 . There are also similarities, but to a less degree, with *S. papuensis* Scheller from Papua New Guinea (Scheller, 1996) and *S. segniter* Scheller from Sabah (Scheller *et al.*, 1994) as to the antennae, the cuticle of the tergites and some pygidial characters.

DESCRIPTION: *Length* = (0.41-)0.42(-0.48) mm.

Antennae (Fig. 138): Antennae glabrous; segment 4 with 3 cylindrical, blunt, sparsely and weakly striate setae, their lengths: $p = p'' = 7(-8) \mu\text{m}$, $p' = 6(-7) \mu\text{m}$.



Figs 138-150

Samarangopus interstinctus sp. n., holotype. ad. 9(δ). (138) right antenna, sternal view; (139) collum segment, median and left part, sternal view; (140) tergite I, anterior margin with campanulate protuberances and fungiform organs, tergal view; (141) tergite I, posterolateral corner with marginal protuberances, sternal view; (142) tergite I, central part with elevated cuticle and fungiform organs; (143) tergite I, posterior margin; (144) tergite VI, posterior margin between insertion cavities of T_5 , tergal view; (145) fungiform organ; (146) T_3 ; (147) genital papillae and seta on coxa of leg 2, anterior view; (148) seta on coxa of leg 9; (149) tarsus of leg 9; (150) pygidium, median and left part, sternal view. Scale a: Figs 140-143, 145, 147; b: Fig. 139; c: Figs 138, 144, 146, 148-150.

Sternal branch *s*, with shallow anterior indentation, anterior margin = 7 μm , posterior margin = 11(-12), \emptyset of base = 5(-6), maximum \emptyset = 7(-8) μm , *q* cylindrical, blunt, striate, *l* = 12(-14) μm . Posterior margin/length of *g* 1.7(-2.9), posterior margin/maximum \emptyset = 1.5(-1.6), maximum \emptyset/\emptyset of base = (1.3-)1.5. Tergal branch *t* somewhat fusiform, *l* = (12-)13 μm , \emptyset of base = 5, maximum \emptyset = 6 μm ; pore not ascertained; length of *t*/maximum \emptyset = (2.0-)2.2. Globulus *g*, *l* = 6(-7) μm , maximum \emptyset = (4-)5 μm ; length/maximum \emptyset = 1.2(-1.4); number of bracts 8(-9), their length = 5 μm , capsule hemispherical with flattened bottom, \emptyset = 3(-4) μm . Relative lengths of flagella (base segments included) and base segments: $F_1 = 100$, $bs_1 = 16(-17)$, $F_2 = 42(-48)$, $bs_2 = (9-)10(-12)$, $F_3 = 83(-90)$, $bs_3 = 13(-14)$. F_1 4(-4.4) times as long as tergal branch *t*, F_2 and F_3 (1.6-)1.7 and 3.4(-3.5) times as long as sternal branch *s*. Calyces subhemispherical, those of F_1 largest, those of F_2 smallest.

Trunk: Setae of collum segment (Fig. 139) short, furcate, primary branch cylindrical, blunt, striate, secondary branch rudimentary, glabrous, submedian seta *l* = 6 μm , somewhat shorter than sublateral seta. Sternite process broad, anteriorly rounded, no incision. Appendages short, subcylindrical, caps flat. Process and appendages glabrous.

Tergites: Anterior and lateral margins of tergite I (Figs 140-141) with a single row of campanulate, glabrous protuberances; lateral margins of other tergites with similar type of protuberances, but longish. Number of marginal protuberances: I. (23-)24(-25); II, 1 small - T_1 - 1 small + 7(-9) + 1 small; III, 4 - T_2 - 1 small + 4(-5) + 1 small; IV, (4-)5 - T_3 - 1 small + 4; V, (4-)5 - T_4 - 1 small + 3; VI, (1 small + 3)4 - T_5 - 1(-2) + 2 small. Cuticle (Figs 142-143) thick, with coarse surface set with small cones and several fungus- or umbrella-like organs consisting of a clavate or almost cylindrical stalk covered by a circular, transparent plate similar an umbrella or a hat of a fungus (Figs 140, 145).

Bothriotricha: All but T_3 with very thin axes; these glabrous except for a minute pubescence on their distal third. T_3 (Fig. 146) glabrous and with thicker axes and distal swelling. Relative lengths of bothriotricha (for holotype only): $T_1 = 100$, $T_2 = 114$, $T_3 = 68$, $T_4 = 90$, $T_5 = 81$.

Genital papillae (Fig. 147): Base segments long and wide, in the shape of a truncated cone, papilla conical, with strongly narrowing distal part. Length of papillae = 20 μm , greatest \emptyset = 12 μm , length of seta = 30 μm ; papilla 1.7 times as long as greatest diameter, seta 1.5 times as long as length of papilla. Cuticle glabrous. Coxal seta of leg 2 with short and thin but not rudimentary secondary branch, length of seta = 13 μm .

Legs: All legs 5-segmented. Seta on coxa (Fig. 148) and trochanter of leg 9 similar to each other, furcate, striate; length of secondary branch 0.6 of primary one. These setae on more anterior legs with rudimentary pointed glabrous secondary branches, but not so in leg 2 in males. Tarsi short, tapering, length in leg 9 (19-)20 μm , in leg 1 (14-)15(-16) μm . Tarsus of leg 9 (Fig. 149) (1.9-)2.0 times as long as greatest diameter, with two tergal setae, both pointed, proximal seta, *l* = 5 μm , glabrous, 0.3 of length of tarsus and 1.7 times as long as distal striate seta, its length = 3 μm . Cuticle of tarsi glabrous. No proximal seta on tarsus of leg 1. All legs with large main claw and small setose anterior secondary claw; in leg 9 the former reaching 0.7 of length of tarsus. A blunt glabrous appendage on anterior side of femur of leg 1, its length = 3 μm .

Pygidium (Fig. 150): *Tergum*. Posterior margin with two narrowly triangular, posteriorly directed jags protruding from level of setae a_2 ; small semicircular lobe protruding backwards above anal plate. Setae glabrous, a_1 and a_2 cylindrical, blunt, the former protruding backward and the latter converging, a_3 tapering, curved inward, converging, st somewhat clavate, directed posteriorly. Lengths of setae: $a_1 = a_2 = 5$, $a_3 = st = (6-7) \mu\text{m}$. Distance $a_1 - a_1 = 9(-10) \mu\text{m}$, $a_2 - a_2 = (25-27) \mu\text{m}$, $a_3 - a_3 = (30-32(-33)) \mu\text{m}$, $a_1 - a_2 = 6 \mu\text{m}$, $a_2 - a_3 = (3-4) \mu\text{m}$, $st - st = (6-7) \mu\text{m}$. Distance $a_1 - a_1$ 1.8(-2.0) times as long as a_1 , distance $a_1 - a_2$ 1.5(-2.0) times as long as distance $a_2 - a_3$; distance $st - st$ as long as st and 0.7 of distance $a_1 - a_1$. Cuticle glabrous.

Sternum. Posterior margin between b_1 with shallow indentation. Setae thin, tapering, striate, their lengths: $b_1 = 24(-26) \mu\text{m}$, $b_2 = 14(-15) \mu\text{m}$, $b_3 = (15-16) \mu\text{m}$. Distance $b_1 - b_1 = 22(-23) \mu\text{m}$, $b_2 - b_2 = (37-40(-41)) \mu\text{m}$, $b_3 - b_3 = (15-16) \mu\text{m}$, $b_1 - b_2 = 16 \mu\text{m}$, $b_2 - b_3 = 13(-14) \mu\text{m}$. b_1 0.9 of interdistance, b_2 about as long as distance $b_1 - b_2$, b_3 as long as interdistance. Sternum glabrous.

Anal plate 1.3 times as long as broad, broadest in the middle, lateral margins convex anteriorly, concave posteriorly; distal part of plate cleft by a U-shaped incision, depth about 1/3 of length of plate, incision forming two posterior branches with sub-parallel sides. Each of the posterior branches with a clavate appendage protruding backward, length of appendage 0.3 of length of plate. Plate glabrous, distal appendages with somewhat granular surface.

26. *Samarangopus sarawakensis* sp. n.

Figs 151-162

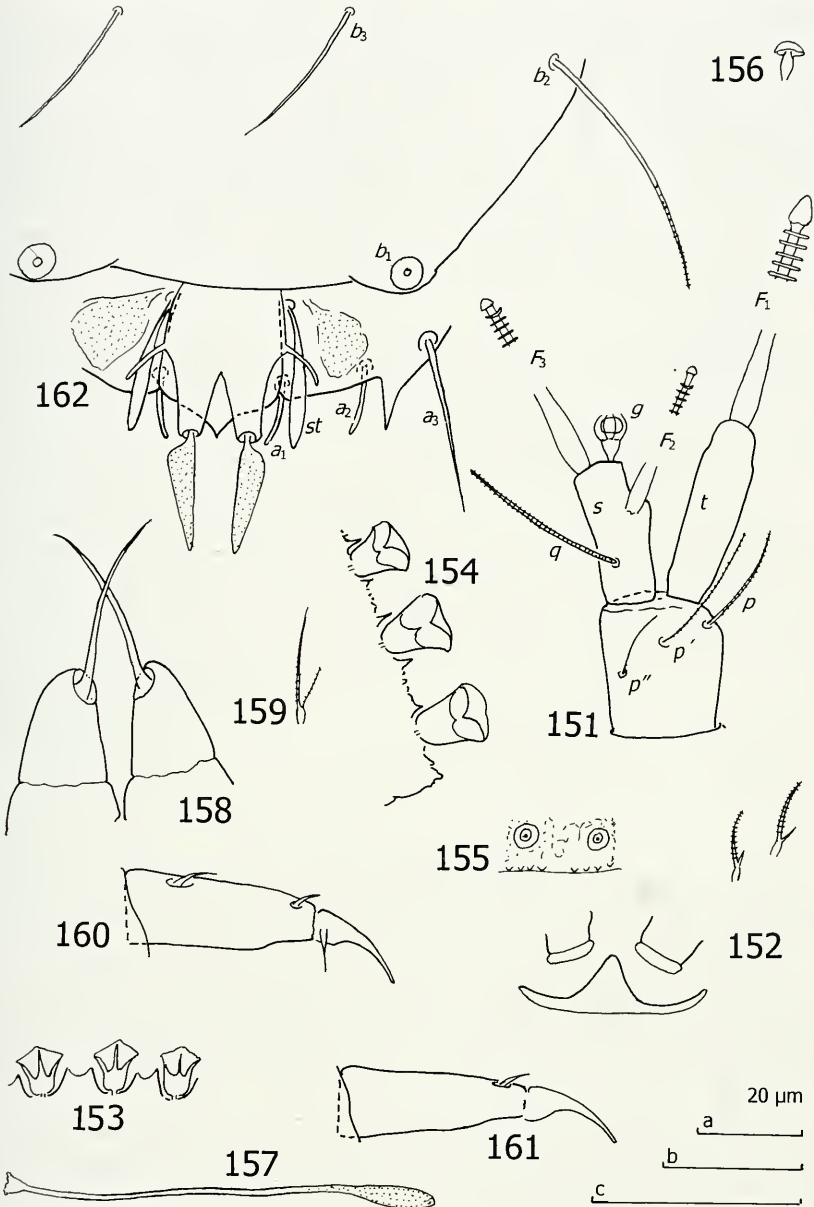
TYPE MATERIAL: Holotype: ad 9(♀), Malaysia, Sarawak, Kuching-Matang road, Gunung Serapi, soil sample (extraction at Kuching) from forest along road to the TV-station, alt. 670 m, 9.XII.1987 (loc. Sar-87/64, leg. Hauser). Paratypes: 8 ad. 9(3♂, 5♀), 1 juv. 5, same data as for holotype. – Altogether 10 specimens.

ETYMOLOGY: A latinized adjective of the name Sarawak.

DIAGNOSIS: *S. sarawakensis* sp. n. is most closely related to *S. ternarius* Scheller from Sabah (Scheller, 2001). They are similar, e. g. in the shape of the antennae, the protuberances of the tergites and the appendages of the collum segment. The following characters are useful for distinguishing these two species: the shape of the collum process (triangular and without anterior incision in *S. sarawakensis* sp. n., broadly rounded with anterior incision in *S. ternarius*), the shape of the genital papillae (distal part rounded without processes in *S. sarawakensis* sp. n., with three processes around the seta in *S. ternarius*), the distal part of bothriotricha T_3 (rounded distally in *S. sarawakensis* sp. n., cut squarely distally in *S. ternarius*), the shape of the posterior margin of the median subtergal plate (with point in *S. sarawakensis* sp. n., rounded in *S. ternarius*) and the setae b_2 of the pygidial sternum (thin, tapering in *S. sarawakensis* sp. n., lanceolate and with wings in *S. ternarius*).

DESCRIPTION: *Length* = (0.64-)1.07 mm.

Antennae (Fig. 151): Glabrous; segment 4 with 3 tapering, indistinctly striate setae, their lengths (for holotype only): $p = 18 \mu\text{m}$, $p' = 20 \mu\text{m}$, $p'' = 10 \mu\text{m}$. Sternal branch s , anterior margin = $14 \mu\text{m}$, posterior margin = $18 \mu\text{m}$, \emptyset of base = $7 \mu\text{m}$, maximum $\emptyset = 10(-11) \mu\text{m}$, q thin, tapering, indistinctly striate, $l = 25 \mu\text{m}$. Posterior



Figs 151-162

Samarangopus sarawakensis sp. n., holotype, ad. ♀ (♀). (151) right antenna, sternal view; (152) collum segment, median and left part, sternal view; (153) tergite I, anterior margin, sternal view; (154) tergite I, left posterolateral corner, sternal view; (155) tergite II, posterior margin; (156) tergite II, fungiform structure, lateral view; (157) T_3 ; (158) genital papillae, anterior view; (159) seta on coxa of leg 9; (160) tarsus of leg 9; (161) tarsus of leg 1; (162) pygidium, median and left part, sternal view. Scale a: Figs 152, 155; 158-161; b: Figs 151, 153-154, 157; c: Figs 156, 162.

margin/length of g (2.3-)-2.6, posterior margin/maximum \emptyset = (1.8-)-1.9, maximum \emptyset/\emptyset of base = 1.4(-1.6). Tergal branch subcylindrical, l = (25-)-27 μm , \emptyset of base = 5 μm , maximum \emptyset = 8(-9) μm ; pore not ascertained; length of t /maximum \emptyset = (2.8-)-3.4. Globulus g , l = 7(-8) μm , maximum \emptyset = 5 μm ; length/maximum \emptyset = 1.4(-1.6); number of bracts (7-)-8, their length = 4 μm , capsule subspherical, bottom somewhat flattened, \emptyset = 4 μm . Relative lengths of flagella (base segments included) and base segments: F_1 = 100, bs_1 = (14-)-15, F_2 = (43-)-46, bs_2 = (7-)-8, F_3 = (89-)-100, bs_3 = (15-)-16. F_1 3.3(-3.5) times as long as tergal branch t , F_2 and F_3 (2.1-)-2.2 times as long as and (0.8-)-0.9 of length of sternal branch s , respectively. Calyces of F_1 largest, conical, those of F_2 and F_3 , small, hemispherical.

Trunk: Submedian setae of collum segment (Fig. 152) furcate, main branch tapering, striate, secondary branch rudimentary, pointed, glabrous, submedian seta l = 13 μm , sublateral seta l = 15 μm . Sternite process triangular, anteriorly rounded, no anterior incision. Appendages cylindrical, caps flat, somewhat larger than distal part of appendages. Process and appendages glabrous.

Tergites: Tergite I with a single marginal row of campanulate, glabrous protuberances (Figs 153-154); protuberances of anterior and lateral margins with tergal side somewhat triangularly lengthened, protuberances of anterior margin with median outward directed spine and protuberances of lateral margins with lengthened part folioform, pointed, turned downwards distally. Number of marginal protuberances: I, (27-)-31; II, 1 small - T_1 - 1 small + (8-)-9; III, 1 small + 5(-6) - T_2 - 1 small + 6; IV, 1 small + 6 - T_3 - (4-)-5(-6); V, (6-)-8 - T_4 - 4; VI, 6 - T_5 - 1. Cuticular surface coarse, near margins and especially on posterior parts of tergites with many fungiform structures (Figs 155-156); the latter with the top covered by a small transparent cover in the shape of a mushroom hat or of an umbrella.

Length/width ratio of tergites: I = 0.5(-0.6), II = 0.6, III = (4-)-0.5, IV = V = VI = 0.5.

Bothriotricha: All but T_3 with very thin glabrous axes. T_3 (Fig. 157) with thicker axes and distal endswelling with weak pubescence. Relative lengths of bothriotricha (for holotype only): T_1 = 100, T_2 = 105, T_3 = 55, T_4 = ?, T_5 = 126.

Genital papillae (Fig. 158): (As long as -)1.2 times as long as greatest width. Base segments almost half of length of papillae. Length of papillae = 20 μm , greatest \emptyset = 17(-20) μm , length of seta = 35(-38) μm . Papilla slowly tapering, rounded distally, opening of inserting cavity of seta circular, seta thick, (1.9-)-2.1 times as long as length of papilla. Cuticle glabrous. Coxal seta of leg 2 as on leg 1, length = 20 μm .

Legs: All legs 5-segmented. Seta on coxa (Fig. 159) and trochanter of leg 9 thin, furcate, striate, with glabrous base; length of secondary branch 0.4 of primary one. More anterior setae with rudimentary pointed glabrous secondary branches. Tarsi, tapering, those of leg 9 (Fig. 160) 1.6(-1.7) times as long as greatest diameter, with two tergal setae, both pointed glabrous. Proximal seta 9(-10) μm , distal one 4(-5) μm . Proximal setae (0.2-)-0.3 of length of tarsus and 2.0(-2.2) times as long as distal seta. Cuticle of tarsus glabrous. No proximal seta on tarsus of leg 1 (Fig. 161). All legs with large main claw and small setose anterior secondary claw; in leg 9 the former reaching 0.6 of length of tarsus. A triangular glabrous appendage on anterior side of femur of leg 1, its length = 5 μm .

Pygidium (Fig. 162): *Tergum*. Posterior margin with two narrowly triangular, pointed jags protruding backward from between setae a_2 and a_3 ; a shield-like lobe, posteriorly with triangular point, protruding backward above anal plate. Setae glabrous, a_1 and a_2 cylindrical, blunt, somewhat curved inward, a_3 straight, tapering, pointed, diverging; st cylindrical in proximal 1/4, more outward lanceolate. Lengths of setae: $a_1 = (5-)$ 6 μm , $a_2 = (4-)$ 6 μm , $a_3 = (14-)$ 17 μm , $st = (12-)$ 14 μm . Distance $a_1 - a_1 = (10-)$ 11 μm , $a_2 - a_2 = (25-)$ 27(-28) μm , $a_3 - a_3 = (38-)$ 39(-42) μm , $a_1 - a_2 = 9$ μm , $a_2 - a_3 = (10-)$ 11(-12) μm , $st - st = 11(-13)$ μm . Distance $a_1 - a_1$ 1.8(-2.0) times as long as a_1 , distance $a_1 - a_2$ 1.3 times as long as distance $a_2 - a_3$; distance $st - st$ 0.8(-1.0) of length of st and 1.1(-1.2) times as long as distance $a_1 - a_1$. Cuticle glabrous except for two small areas outside st .

Sternum. Posterior margin between b_1 with low and broad bulge. Setae b_1 lost, b_2 tapering, pointed, distal half with very short pubescence, b_3 thin, tapering, pointed, glabrous. Lengths of setae: $b_2 = (25-)$ 27(-30) μm , $b_3 = (14-)$ 15 μm . Distance $b_1 - b_1 = (34-)$ 36 μm , $b_2 - b_2 \approx 60$ μm , $b_3 - b_3 = 22(-28)$ μm , $b_1 - b_2 = 25(-29)$ μm , $b_2 - b_3 \approx 20$ μm . b_2 (as long as -)1.1 times as long as distance $b_1 - b_2$, b_3 (0.5-)0.6 of interdistance.

Anal plate 1.4(-1.5) times as long as wide, broadest at level of lateral appendages, these thin, cylindrical, blunt, glabrous, protruding obliquely backward; appendages 0.3 of length of plate; posterior half of plate divided into two tapering branches by a V-shaped incision, each branch provided with an almost glabrous stalked bladder, in sternal view similar to a knife-blade. These appendages 0.8 of length of plate. Plate and sternum glabrous.

Sphaeropauropodinae

Genus *Sphaeropauropus* Silvestri, 1930.

27. *Sphaeropauropus arcuatus* Scheller

Sphaeropauropus arcuatus Scheller, 2001: 981-984, figs 105-117.

MATERIAL EXAMINED: Indonesia, Java, Cibodas, *Lithocarpus-Castanopsis* forest above the Botanical Garden, tourist trail to the waterfall, soil sample (extraction at Kuching, Sarawak) from between buttresses of large trees, alt. 1380 m, 1 ad. 9(δ), 26.XI.1987 (loc. Sar-87/21, leg. Hauser). – Malaysia, Sarawak, Kuching-Matang road, Gunung Serapi, soil sample (extraction at Kuching) from forest along road to the TV-station, alt. 670 m, 3 ad. 9 (φ), 9.XII.1987 (loc. Sar-87/64, leg. B. Hauser); road Kuching-Serian, 18 km from Kuching, near Kampong Kuap, secondary forest, soil sample (extraction in Geneva) from between buttresses of a large tree, alt. 30 m, 1 ad. 9(sex?), 1 juv. 6, 13.XII.1987 (loc. Sar-87/86, leg. B. Hauser). – Altogether 6 specimens.

GENERAL DISTRIBUTION: The species is here reported for the first time from Java. It was previously known from Sabah only (Scheller, 2001).

REMARKS

Pauropods have been almost unknown from the Indo-Australian area. Disregarding from Sabah in East Malaysia, only a few accidentally found species have been reported from Java (one species, Remy, 1933), Mindanao, the Palau Islands and Guam (five species, Remy, 1957d) and Papua New Guinea (one species, Scheller, 1996). The collections from Sabah, 99 specimens in all (Scheller *et al.*, 1994; Scheller, 2001), contain 18 identified species, only three of which distributed elsewhere.

The collection studied here, with 104 specimens from Singapore, Java, Bali and Sarawak, is the first one of importance from the Indonesian island arch and is one of the largest collections brought together from the Indo-Australian region. In comparison to the number of specimens, the number of species, 27, is considerable. Many of them, 18 (67%), are new to science and only nine were known earlier from other areas. Part of the material comes from botanical gardens and the like, but these figures are similar to those earlier presented for New Caledonia (Scheller, 1993). 127 specimens from there were studied and 18 new species were identified (82% of total number of species found), only four widespread species could be found. A similar picture appears when comparing the faunas of north-western Thailand, 54 specimens, 10 new species (71% of total number of species found) (Scheller, 1995), south Vietnam, 45 specimens, 7 new species (87% of total number of species found) (Scheller, 2004) and Sabah, 99 specimens, 14 new species (78% of total number of species found) (Scheller *et al.*, 1994; Scheller, 2001).

Nine of the studied species studied above have been met with before. Four of them were known from Sabah: *Hemipauropus dispar* Scheller, *Brachypauropoides penanorum* Scheller, *Samarangopus longipenes* Scheller and *Sphaeropauropus arcuatus* Scheller. The three former can now be included in the fauna of Sarawak too, and the last mentioned also occurs on Java. They may all belong to an old Indo-Australian faunal element. Of the five remaining species described earlier, *Allopauropus manjakotompensis* Remy & Bello and *A. pumilio* Remy have been reported from Madagascar and Réunion, respectively, and may be a part of an old Gondwanan fauna. This means that only three of the species in this material have ranges extending outside the Oriental region: *Allopauropus proximus* Remy, *A. pulcher* Remy and *A. mortensenii* (Hansen). The first mentioned is widely distributed in the tropics but the whole distributional range of the other two is currently not known. *A. pulcher* was described from South Africa and has later been found in the USA, and records of *A. mortensenii* also show a very discontinuous picture including Egypt, Sri Lanka, Réunion, Mauritius, Koh Chang in the Gulf of Thailand and New Caledonia. There is also a doubtful record from Australia (Harrison, 1914). Accordingly only three species of 27 reported here have ranges extending outside the Oriental region. The wide range element is poor.

The high portion of new species and the presence of only a few widespread species indicate a strong endemism in the Southeast Asian pauropod fauna. All available collections indicate a poorly known fauna with a high species diversity.

ACKNOWLEDGEMENTS

I am indebted to the Drs Bernd Hauser, Charles Lienhard and Pierre Strinati for sending me the material, which formed the basis of this study.

REFERENCES

- ATTEMS, C. 1938. Die von Dr. C. Dawydoff in französisch Indochina gesammelten Myriopoden. *Mémoires du Muséum nationale d'Histoire naturelle (Paris)* (N.S.) 6(2): 187-353.
- HANSEN, H.J. 1902. On the genera and species of the order Pauropoda. *Videnskabelige Meddelelser fra Dansk Naturhistorisk Forening i Kjøbenhavn* 1901: 323-424, plates 1-6.

- HARRISON, L. 1914. On some Pauropoda from New South Wales. *Proceedings of the Linnean Society of New South Wales* 39: 615-634, plates 70-71.
- REMY, P.A. 1933. Un Pauropode nouveau d'Indochine: *Pauropus Dawydoffi* n. sp. *Faune des Colonies françaises (Paris)* 5(3): 190-193.
- REMY, P.A. 1945. Nouvelle contribution à la faune des Myriapodes de Corse. *Mémoires du Muséum national d'Histoire naturelle (Paris)* (N.S.)21(4): 117-152.
- REMY, P.A. 1948a. Pauropodes de l'Afrique orientale britannique. *Proceedings of the Zoological Society of London* 118: 568-574.
- REMY, P.A. 1948b. Pauropodes de la Côte d'Ivoire, Afrique occidentale française. *Mémoires du Muséum national d'Histoire naturelle (Paris)* (N.S.) 7(5): 115-151.
- REMY, P.A. 1950. Pauropodes de Basse Egypte (récoltés de B. Condé). *Bulletin de l'Institut d'Égypte* 32: 35-48.
- REMY, P.A. 1952. Pauropodes de Nouvelle-Zélande. *Record of the Canterbury Museum Christchurch* 6(2): 167-179.
- REMY, P.A. 1956a. Pauropodes de Madagascar. *Mémoires de l'Institut scientifique de Madagascar* (A)10: 101-229.
- REMY, P.A. 1956b. Pauropodes d'Afrique du Sud. *Bulletin du Muséum national d'Histoire naturelle (Paris)* (2) 28(3): 296-299.
- REMY, P.A. 1956c. *Allopauropus pulcher*, nouveau Pauropode d'Afrique du Sud. *Annals of the Natal Natal Museum* 13(3): 445-446.
- REMY, P.A. 1956d. Pauropodes des États-Unis d'Amérique. *Mémoires de la Société nationale des Sciences naturelles et mathématiques de Cherbourg* 47: 1-48.
- REMY, P.A. 1956e. Pauropodes de l'île de la Réunion. *Mémoires de l'Institut scientifique de Madagascar* (A)11: 127-166.
- REMY, P.A. 1957a. Pauropodes des États-Unis (Tennessee, North Carolina). *Revue française d'Entomologie* 24(1): 82-87.
- REMY, P.A. 1957b. Description d'un nouveau Pauropode de Nouvelle-Calédonie. *Bulletin du Muséum national d'Histoire naturelle (Paris)* (2) 28(6): 519-523.
- REMY, P.A. 1957c. Additions à la faune pauropodienne de Côte d'Ivoire (récoltes de Stéphane et Blandine Bricka). *Bulletin de l'Institut française d'Afrique noire* (A)19(3): 751-762.
- REMY, P.A. 1957d. Pauropoda. In: BERNICE P. Bishop Museum (ed.). *Insects of Micronesia (Honolulu)* 4(1): 1-12.
- REMY, P.A. 1959. Pauropodes de l'Île Maurice. *The Mauritius Institute Bulletin* 5: 149-194.
- REMY, P.A. 1961. Pauropodes de la région de Pondichéry (Inde). *Mémoires de la Société nationale des Sciences naturelles et mathématiques de Cherbourg* (5)9: 1-24.
- REMY, P.A. 1962. Quelques Pauropodes de Ceylan. *Izdaniya. Zavoda za ribarstvo na N.R. Makedonija* 3(2): 131-136.
- REMY, P.A. & BELLO, J. 1960. Pauropodes du massif de l'Ankaratra (Madagascar). *Mémoires de l'Institut scientifique de Madagascar* (A)14: 71-93.
- SCHELLER, U. 1970. The Pauropoda of Ceylon. *Entomologica Scandinavica, Supplementum* 1: 5-97.
- SCHELLER, U. 1988. The Pauropoda (Myriapoda) of the Savannah River Plant, Aiken, South Carolina. *Savannah River Plant and National Environmental Research Park Program (SRO-NERP)* 17: 1-99.
- SCHELLER, U. 1993. Pauropoda (Myriapoda) from New Caledonia. (pp. 25-71). In: MATILE, L., NAJT, J. & S. TILLIER (eds). *Zoologia neocaledonica* 3(34). *Mémoires du Muséum national d'Histoire naturelle (Paris)* 157.
- SCHELLER, U. 1995. Pauropoda (Pauropodidae Eurypauropodidae) from north-western Thailand. *Tropical Zoology* 8(1): 7-41.
- SCHELLER, U. 1996. A new species of *Samarangopus* (Myriapoda: Pauropoda) from Papua New Guinea. *Records of the Western Australian Museum* 18: 87-91.

- SCHELLER, U. 2001. Pauropoda (Myriapoda) from Sabah (East Malaysia) (Pauropoda and Symphyla of the Geneva Museum XI.) *Revue suisse de Zoologie* 108: 949-986.
- SCHELLER, U. 2004. Pauropoda (Myriapoda) from Vietnam (Pauropoda and Symphyla of the Geneva Museum XIII.) *Revue suisse de Zoologie* 111: 77-101.
- SCHELLER, U., BRINCK, P. & ENCKELL, P.H. 1994. First record of Pauropoda (Myriapoda) on Borneo. *Stobaeana (Lund)* 1: 1-14.
- SCHELLER, U. & BERNARD, E.C. 2005. New species of Pauropoda. (Pauropodidae, Brachypauropodidae) from Great Smoky Mountains National Park (Tennessee, North Carolina, USA), and a list of known species. *Proceedings of the Biological Society of Washington* 118(4): 815-854.
- SILVESTRI, F. 1902. Ordo Pauropoda. In: BERLESE, A. (ed.). *Acari, Myriopoda et Scorpiones hucusque in Italia reperta. Portici.*
- SILVESTRI, P. 1930. Descrizione di due nuovi Pauropodi (Myriapoda) di Giava. *Bollettino del Laboratorio di Zoologia generale e agraria della Facoltà agraria in Portici* 23: 227-231.
- VERHOEFF, K.W. 1934. Symphyla und Pauropoda. Pauropoda. (pp. 120-200). In: BRONNS, H.G. (ed.). *Klassen und Ordnungen des Tierreichs, 5 Arthropoda, 2 Myriapoda, 3 Symphyla und Pauropoda, 2 Pauropoda. Akademische Verlagsgesellschaft, Leipzig.*